

The Iron Age

A Review of the Hardware, Iron and Metal Trades.

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Decorative Ironwork.

The following interesting article, by Mr. George Wallis, is from the *Magazine of Art*:
Ironwork for domestic use in the internal arrangements, and in a measure as part of the furniture, or at least the fittings, of the houses of the period included within the dates from the fourteenth to the eighteenth century, presents many valuable and interesting features alike to the artist as to the archaeologist. No doubt many of the objects then in every day use, and almost necessary to the comfort of the class of society in which the best examples were to be found, have been superseded by articles of a more convenient construction, made of materials more suitable to their use. Jewel caskets and iron chests, for example, may be quoted as not at all likely to have any revival in these days. Something equally—possibly even more—secure from surreptitious investigation has taken the place of the cumbersome objects belonging to the periods above mentioned; and while the art displayed in the modern decoration of such objects may be anything but satisfactory, yet convenience has its claims to attention, and in the multiplicity of wants in an age like our own, economy of time, and consequently of cost, becomes a compulsory matter. Hence we dispense with the elaborate decoration of a deed or plate chest, and simple security is all that we care to think of in connection with a repository for our valuables.

The iron coffer numbered 4255-66 in the South Kensington museum is a notable example of this class of decorative wrought iron. It is Nuremberg work of the early part of the eighteenth century, and illustrates the "safes of the period." It shows how these repositories for valuables of all kinds were regarded as essentially a portion of the furniture of a well-garnished house, and that they were made, not to put away in corners or out-of-the-way places, but to stand as ornaments, as well as objects of use, in prominent positions; the locks, bolts and bars with which they were furnished being a sufficient justification for regarding them as safe from prying curiosity or the arts of the thief in relation to their contents. Such objects were thought worthy of the best ability of the artist-smiths of the centuries we have already indicated. This example, of which we give an illustration, (p. 3) is decorated on top with *appliqué* scrollwork in *repoussé*, admirably designed and executed. These scrolls are adapted to the shapes of the panels formed by the flat bands of iron which are themselves incised with scroll ornaments, the bands giving strength to the top of the coffer, and thus forming a detail in the decoration. From the cover of the key-hole, or rather of the escutcheon which surrounds it in the center of the top—this cover being formed of a mask in *repoussé*—an ornament starts which forms a rosette. The scrolled details of this ornament run into the four panels constituting the central compartments, two panels at each end of the lid completing the design. The border-band of each is decorated with scroll work and rosettes in bold relief; and studs, also in high relief, complete the details of the ornamentation, the effect being rich and singularly appropriate. The sides and ends are also decorated and paneled, the panel-bands being incised and studded. Boldly designed forged handles complete the two ends. The front is of the same character, while two ornamental clasps in chiseled ironwork form an excellent padlock staple. Both angles of the front are decorated with forged spirals fixed as columns, and rising from brackets resting on the front feet. The body of the coffer is supported on a stand admirably designed and executed; it is composed of four feet with chiseled iron scrolls in forged work issuing from the angles formed by each foot, which at once strengthen the support and add to the decorative effect of the work. The lock is, as usual in these coffers, inside the lid, and covers the whole space except the margin corresponding to the rim round the inside of the upper edges of the chest. This margin is decorated with a foliated tooth-like ornament, the lock itself projecting from it. The design of the lock-plate is executed in perforated sheet iron, polished, and is divided into two panels, with a boss in the center corresponding to the key-hole. In one panel is a double-headed eagle with an imperial crown, surrounded by a bold foliated ornament. The breast of the eagle bears a shield charged with two keys crossed and a hammer—a device of the maker. Engraved on the outer rim, in German, is, "This lock has been made by Benedict Hild, locksmith." In the other panel a similar ornament surrounds the façade of a palace. The details of these ornaments, as also of the eagle and palace, are admirably etched. The date is quoted inside (1716). The lock has eighteen bolts, which shoot under the inside rim already mentioned.

The coffers of the sixteenth, seventeenth and early part of the eighteenth centuries differed considerably in various countries and localities, alike in construction and decoration. The example just quoted is of a class in which the whole design is legitimately adapted to iron, alike in construction and decoration. In Germany, Flanders, and sometimes in England, coffers of comparatively plain construction, being simply an iron chest body, bound round by broad bands of iron riveted through the construction plates, were in common use. Not unfrequently they were painted and gilt, the bands being of one color, and the panels formed by these bands being of another; the rivets were gilt,

and the edges of the bands "picked out" either in gold or in some darker color than that of the panels or the bands themselves. Sometimes the panels were filled with painted devices, heraldic or symbolical, and at others a series of heads formed the decoration. Occasionally a whole subject, historical or religious, was represented, and intercepted only by the bands passing over it; for, as already stated, these chests were important pieces of furniture in well-appointed houses, and were rendered as decorative as possible, the finest being invariably those which, like our illustrative example, were the work of artist-smiths, and ironwork alike in construction and ornamentation.

As another example of this class, the casket (No. 396-54), of sixteenth century Ger-

as to aid the ornamental effect as studs. The lock is in the inside at the top, covering the whole surface, the key-hole being in the middle. The details of this lock are very decorative, being cut into admirably-designed plates covering the angles of the bolt springs. There are seven bolts, all being shot simultaneously by the turn of the key, and they act as claw-bolts under the inside projecting rim of the interior, and make the casket and its contents very secure. As an example of workmanship this specimen is worthy of special examination, while the ornamentation is very suggestive alike as regards the art displayed in the design, and the method by which the decorative effect is realized.

Many jewel caskets of the fifteenth and sixteenth centuries were elaborate examples

than the method of construction; and the ingenuity shown in the designs, and the perfect adaptation of the series of plates to the completion of the full effect, exercised the skill and tested the knowledge of graphic geometry of the mediaeval worker in iron to the full as much as the elaborate carvings in wood and stone exercised the workers in those materials.

The extent to which certain fixed articles of furniture were at once strengthened and decorated by forged ironwork of a highly artistic character was formerly so great that it is difficult in these days of colored woods and French polish to understand how the amount of work was done; but in the period of which we are treating, the smiths of each century must have been as abundant as per-

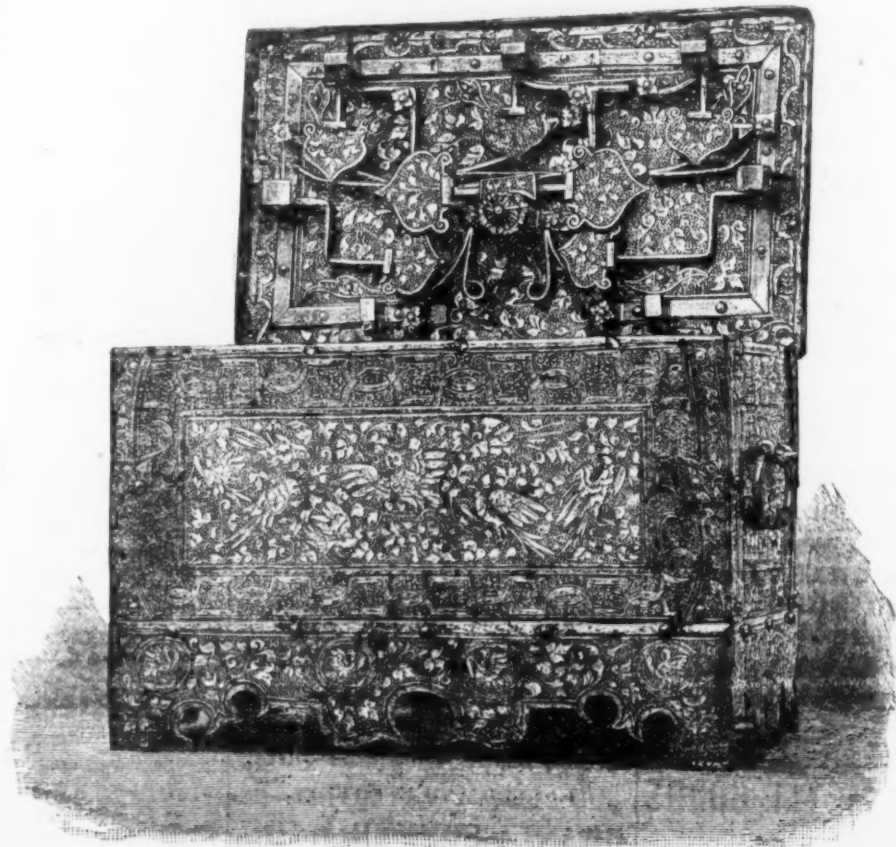
bar. The hinges are so arranged that the main stay-plates are attached to the outside framework, and the hinge proper corresponds with the fit of the door, as the horizontal decoration crosses and secures each door in parallel lines. The binding strength of these decorations is very great. Nothing can be more simple in form and detail than these decorative adjuncts, and yet the ornamental effect is practically perfect. The finish of the ironwork by polishing contrasts admirably with the dark wood on which the ironwork is fixed, but we can conceive that when the whole was now the new oak harmonized with excellent effect with the polished mounts. The introduction of gilt brass or ornolu mounts on furniture in the period and style now known as Louis Quatorze, superseded the modest, but more legitimate iron mounts of a simpler and less ostentatious age, in which utility, strength and solidity were aimed at as the true basis on which decorative effects were produced. In these constructions we had science as a basis, and the ornamentation was invariably designed so as to embellish and enhance the essential construction and form to the eye, and in no sense to conceal, but rather to display, the construction. The debased style of ornamentation which came into vogue with the fripperies of the seventeenth and early eighteenth century French art ignored all science in construction, and undoubtedly led to the utter neglect of all true design, and the final obliteration of the workman-designer alike in wood and metal work.

Our next subject scarcely comes within the range of wrought iron work proper, although it is certainly decorated ironwork. This is a girandole of two lights shown on page 3. It consists of the figure of a female Triton holding a pair of sconces. The figure is in cast iron, produced after the Italian manner, although French of the seventeenth century, by the method used in bronze casting *à la cire perdue*. The ornaments on which the sconces are fixed, as also the sconces themselves, are of forged iron. The double fish tails or basements to the figure are cast solid with the figure itself. The whole work is admirably executed in its style—that is, of bronzework rather than iron. The figure and cast portions are chiseled and finished with a polish which renders the whole an admirable adjunct to a fire-place or a mirror, or as a bracket. A companion work has a male Triton as the subject of the figure. As a matter of technique, the combination of wrought and cast iron in this work is interesting, but the more legitimate method is to construct the work, as a whole, of wrought iron, and then to add the figures in cast iron in such a position in the design that the riveting or screwing on of details is not necessary. The cast portions then take their places as an adjunct to the wrought-iron framework and decoration.

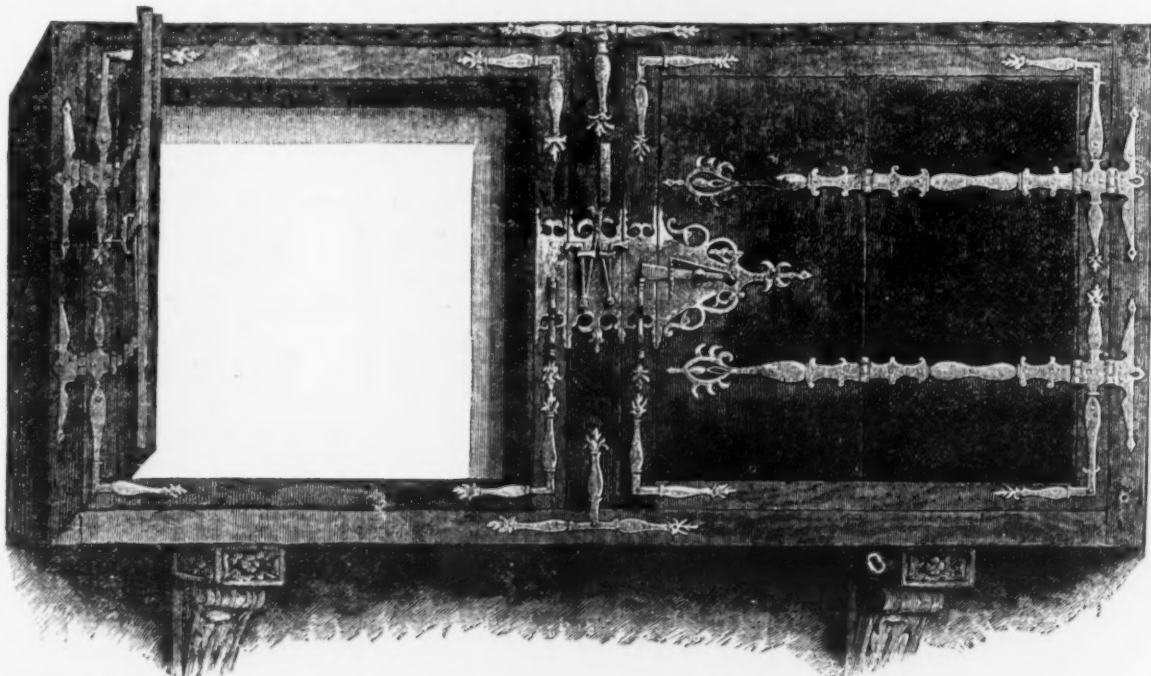
A lock and hasp (No. 4850-53) are of a very different character, being Italian work of the late sixteenth or early seventeenth century. These are examples of the elaborate manner in which locks and door-handle plates were decorated during the latter part of the fifteenth, the whole of the sixteenth, and early part of the seventeenth centuries. The plates of flat forged iron are chiseled into the geometric forms necessary to give effect to the decorations and security to the lock, handle or hasp, of which it is at once the ornament and means of attachment. The plates are perforated by drilling and chiseling into the chequered or foliated designs. These are assisted in the details by incised work, giving the venations of the foliage, and further decorated by punching up from the back studs at stated intervals, in the manner of *repoussé*. The plates are arranged into the form of a St. Andrew's cross, with the locks in the center, the locks being also decorated with incised panel work. The effect here obtained by flat plates perforated and chiseled has a richer, but certainly a less architectural effect than that adopted by the old English workers in iron of our decorated Gothic periods, already alluded to in the remarks on the iron casket, by which an ornamental effect was built up, so to speak, by a series of perforated plates of thin metal worked out geometrically from the plain plate, the general form of the perforations, and so on, to the more complicated details of the top plate, all riveted together in such a manner as to make the heads of the rivets the finishing detail of the whole.

The neglect into which the decorative ironwork of the periods we have endeavored to illustrate has fallen is not only to be regretted, but appears to be quite phenomenal, when we consider the skill and dexterity to which the artist smiths of the seventeenth and early portion of the eighteenth centuries had attained. Change of fashion scarcely seems to account for the facts, and one had only, even within the last quarter of a century, to walk through some of the older quarters of Chelsea and Kensington to discover examples of wrought iron work—gates, pediments, and railings—which were alike admirable in design and execution. Even at the present time a drive through the eastern suburbs of London rewards the admirer of this species of decorative art, so thoroughly English in character, by the discovery of examples, especially gates and pediments, which it would be a difficult matter to copy, without consideration of the ability which originally designed the forms, all thoroughly adapted to the technique of the productions.

Strangely enough, the French appear to have taken a very decided step toward a re-



German Casket.—Sixteenth Century.



German Cupboard Front.—Sixteenth Century.

DECORATIVE IRONWORK.

man work (illustrated above), is of great interest. It is formed of plates of metal, riveted together at the angles, these angles being covered with decorated framing-plates cut to an ornamental profile, which unite with broader plates of a similar character running round the base of the casket, and form an ornamental foot or rest for the whole. The surface decorations consist of an elaborated series of foliated designs, with birds introduced in the central portion, the borders consisting of cartouches. The top is decorated in a similar manner, the whole having been bitten into the surface with a strong acid in the manner of etching, and suggesting a damascened effect, but without the insertion of gold or silver. The angle-plates and the foot-plates are riveted upon the panels, and the rivets are so distributed

of geometric design, in which great ingenuity and skill were shown by those who designed and constructed them. Following the system by which the paneling, window tracery and tabernacle work of the best period of decorated Gothic were constructed, thin plates of metal were perforated by drilling, cutting and filing into tracery so adapted that when a series of plates were laid over each other they formed complete Gothic panels, producing a charming effect of light and shade. These perforated plates, drilled at proper points in the design—a plain plate as the back being drilled to correspond—were riveted together, and formed the sides and top of the casket. The rivet-heads were chiseled into decorative forms, and chased as rosettes in a variety of ways. Nothing in the way of decorative ironwork could be more simple

sons who, in these days, bear the name without following the calling. In the cupboard front (No. 2452-56) we have a German example of about 1550, probably Nuremberg work. It is of oak, overlaid, with polished iron mounts, hinges and latches. It is a singularly perfect illustration of the adaptation of the metal mounts to the doors of a cupboard, or possibly a cabinet fixed in a wall. The design is divided into four spaces by the framed work of the sides and a vertical and horizontal cross-bar, thus forming four doors, each pair having a double fastening working from the vertical bar. The illustration shows the two lower doors only. Highly-decorated bolt-plates of perforated ornament are fixed upon each door—balancing each other—and the bolts of each pair work in opposite directions upon this cross-

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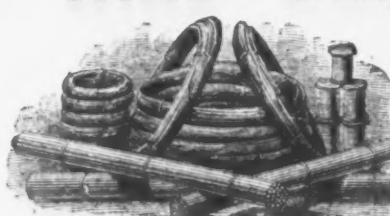
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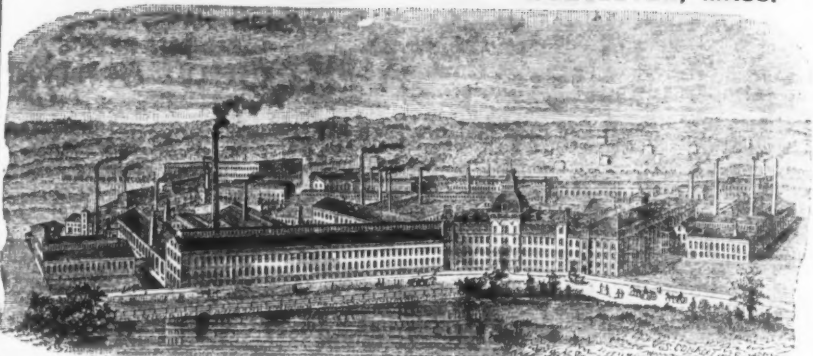
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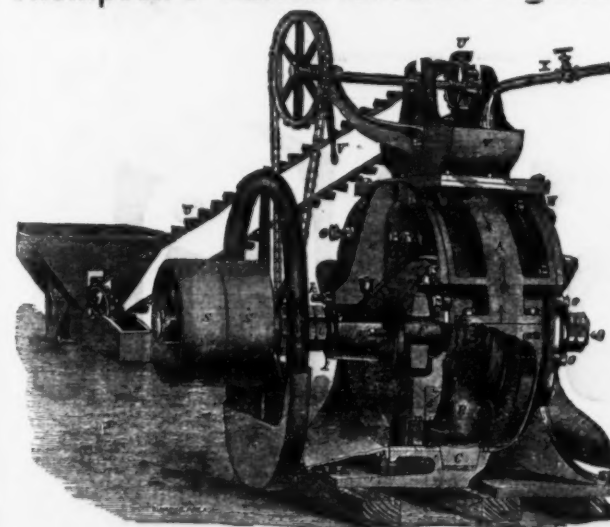
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vival of wrought iron work for ornamental purposes, and it appears, so far, to be chiefly upon the lines of the old English methods, rather than of the Italian, Flemish or German. Whether this will stimulate the half-realized attempts to bring back this old English art industry to the smithies of our own country it is difficult to say. Hitherto the attempts have been mostly overdone, and the simplicity of construction and the ornamentation actually growing out of that construction of the old examples appear not to have been understood; and "stuck on" details intended for ornament, but having little relation to a true ensemble, have degraded some really good work, as regards manipulation and finish. The commercial aspect of such a revival is not a cheering one. The fact that very decorative works in iron can be produced in malleable cast iron is de-

encouragement for similar enterprises is offered by Congress.

A Canadian Parliamentary Debate on the National Policy.

The following extract from the debate in the Ottawa House of Commons on the 21st of February will be read with interest: Sir Leonard Tilley laid on the table the report of the Commissioners appointed to inquire into the working of the mills and factories and the labor employed therein. He also presented a number of returns to orders of the House of Commons.

MESSAGE.
Sir Leonard Tilley brought up a message from His Excellency the Governor-General, which was read by the Speaker as follows:



French Girandole.—Seventeenth Century.

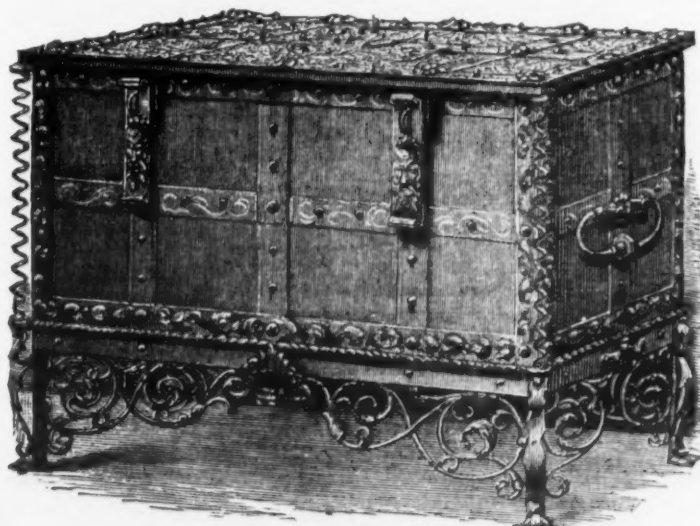
cidedly against the economic use of ornamental wrought iron, except in cases where a single work, or at most a very few repetitions of the same design may be wanted. When the design is available for extended application—such as when applied to railings and decorative mounts for copings—malleable wrought iron has the advantage; and when the design is really adapted to casting, and is not a mere slavish imitation of wrought-iron details, no sound or common-sense aesthetic objection can be taken to its use. The material is tough, and therefore not easily broken. Its surface is even, and it can be cast sufficiently thin with safety to give much of the effect of wrought iron when forged hot. Of course the more delicate de-

"The Governor-General transmits to the House of Commons the estimates of the sums required for the service of the Dominion for the year ending 30th June, 1883, and in accordance with the provisions of the British North American Act he recommends these estimates to the House of Commons."

LORNE.
Sir Leonard Tilley moved that the Message, with the estimates accompanying it, be referred to a Committee of Supply. Carried.

Sir Leonard Tilley stated that the Supplementary Estimates for the current year would be brought down on Thursday.

The House went into Committee of Supply, Mr. Kirkpatrick in the chair, and passed the



German Coffin.—Early Eighteenth Century.

tails of forged ironwork, such as tendrils, rosettes in repoussé, and even the admirable decorative effects produced by rivets in the older works, are impossible. This, however, is the penalty which art has to pay so frequently for the advance of science as applied to the industrial arts.

The second steamer of the new line established between Canada and Brazil, via the West India Islands, is now nearly due at Halifax, and no efforts are spared to promote trade between those points. Mr. Wm. Darley Bentley, Consul-General of the Empire of Brazil, has issued a very comprehensive circular to the merchants of the Dominion, the object of which is to afford them an opportunity of knowing precisely the class of goods which can be had in the British West Indies, Brazil and River Plate, and, on the other hand, the products and manufactures of Canada which would find a ready market there. With subsidies from two governments, in addition to the French bounty received by the company concerned, this enterprise ought to succeed. But what

item of \$11,200 for the Governor-General's Secretary's Office.

The Committee rose, reported the result and obtained leave to sit again on Friday.

RETURNS.

Sir Richard Cartwright, in the absence of Hon. Mr. Blake, moved for a full description of the locality comprised in each census sub-district from A to F, inclusive, of Census District No. 192, "The Territories." Carried.

Mr. Paterson (Brant) in moving for a return of all claims presented for drawbacks on goods manufactured for export since January 22, 1881, said he had examined the trade and navigation returns, and did not find the statement of the Commissioner of Customs correct, that our increased exports were wholly to Great Britain, or were chiefly of goods manufactured in Canada. Of the total increase of \$11,000,000 there was an increase of \$4,891,935 in our exports to the United States in 1881 over 1880, while our exports to Great Britain had increased only \$7,439,128. He did not attach great importance to the fact that the export trade

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was not limited to Great Britain, and was rather pleased that it was otherwise. Still, these statements were misleading. He would be glad if the increase were wholly in our products and manufactures, but it was not the fact, while it was a fact that the exports of agricultural products and products of the forest largely increased in the last year, the manufactures presented a gloomy picture. In fact, the export of our manufactures was steadily diminishing before 1877, the liberal course of the former ministry in aiding the manufacturers of this country (laughter) to exhibit at the world's fairs in Philadelphia, Melbourne and Paris products of our manufacturing industries had established a large export trade, which would have gone on increasing had that government remained in power. The exports of the products of the forest, animals and their products and agricultural products, had increased \$30,321,916 in the last two years, thanks to a merciful Providence, with which honorable gentlemen could not interfere; but where they could they had interfered with the blessings of Providence, and the export of manufactured goods had decreased since 1873 by \$1,052,610. He wanted to see the manufacturers unhampered by the present tariff, but under a revenue tariff free to produce cheaper at home and to compete with foreign manufacturers abroad. Among the manufactures, the export of which had decreased, were some of our most important industries, while from those which had increased in export, scrap iron and rags should be deducted, as they caused no employment of labor. The decreases to which he had referred had been going on so that less was exported in 1881 than in 1880, and less in 1880 than in 1879. In a short time, under the management of honorable gentlemen, we would have to abandon our proud boast that our manufacturers were able to meet those of other countries in the markets of the world. It was not that our manufacturers were lacking in brain and enterprise, but because they had been handicapped by the tariff of the honorable gentlemen opposite. It could not be said that this decrease in the estimates was due to the increase of home consumption, for while there had been a decrease in the increase of pig iron, cottons, boots and shoes, machinery, sewing machines, woollens and other manufactures, there had been also an increase in the imports; but the secret was that the raw material was taxed, and both manufacturers and consumers were suffering under a tariff which was framed on its principle, but was simply a plagiarism from the United States tariff, which was shown to be utterly unsuited to our requirements. The reason for the diminution of the exports was not that our manufacturers had obtained greater control of the home market, but that they were so handicapped that they could no longer produce cheaply at home, or compete successfully abroad. When the opposition said the tax on raw materials would produce this result, they were told it would be remedied by the payment of drawbacks on export goods. Last year a return for 21 months was brought down showing that \$15,379 had been paid for drawbacks, but \$12,000 of this was on lobster cans, and, in fact, not one cent was for the raw material used in any of our great manufactures. He knew of no remedy but a return to a sound revenue tariff, which afforded the manufacturers all the advantages to which they were entitled. In the town he (Mr. Paterson) represented, which was a large manufacturing town, every large manufacturer was his political supporter and the opponent of the honorable gentleman opposite. Last year one of them paid \$6000 more duty than they would have paid under the Mackenzie tariff. The manufacturers had nothing to thank this Government for, unless it were the sugar refinery and one or two more things, and while the manufacturers were not being benefited, the consumers suffered from the increased prices which they had to pay. (Applause).

Mr. Plumb said the arguments of the honorable gentleman appeared to be that because some articles of export had decreased therefore the national policy had injured the manufacturers. He, however, considered that it was a sign of wealth if we were not only to utilize our own products, but to purchase from abroad. The Government had not pretended to build a Chinese wall round this country and shut out all foreign manufactures; they simply desired to give reasonable protection to our home industries, and that had been opposed by honorable gentlemen opposite. He (Mr. Paterson) had stated that the industries in his own town were suffering, but the fact was Brantford had greatly benefited by the national policy.

Mr. Paterson said he had stated they were suffering in their export trade only.

Mr. Plumb ridiculed the idea that manufactures were flourishing under the tariff of the previous government, and pointed out that the whole of the present tariff was not imposed by the present government. The average increase had been stated to be only 5 per cent; the fact was that the opposition were bitterly opposed to the national policy.

Mr. Orton rose to speak, when Mr. Mackenzie asked the honorable gentleman to allow some of the Ministers to answer Mr. Paterson's speech.

Hon. Mr. Bowell said the Ministers would take their own opportunity to reply.

Hon. Mr. Mackenzie: You are afraid to do it to-day.

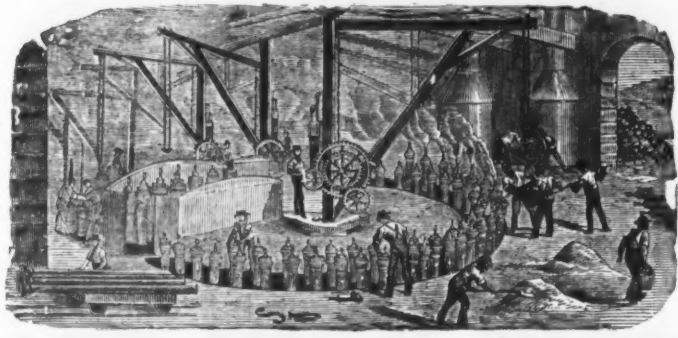
Mr. Orton said that the honorable member's statements proved that the national policy had succeeded in giving our manufacturers control of the home market. The production of manufactured goods in this country had very largely increased, and the people, being more prosperous, had been able to purchase more largely. The reason why more applications had not been made for drawbacks was that the manufacturers were unable to produce fast enough to supply our own people.

Mr. Hesson referred to the generally prosperous condition of the country, and alleged that in Brantford, the honorable gentleman's own city, the manufacturers were more prosperous than they ever expected to be.

Mr. Paterson denied that he had said the manufacturers were not prospering. He had said they were hampered in their export trade. The manufacturers were never enjoying more prosperity than they were to-day (Ministerial cheers), but every class was

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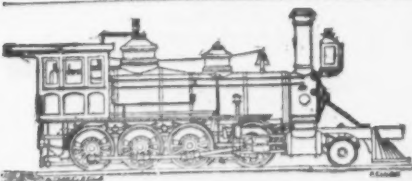
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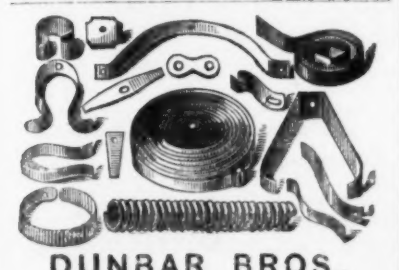
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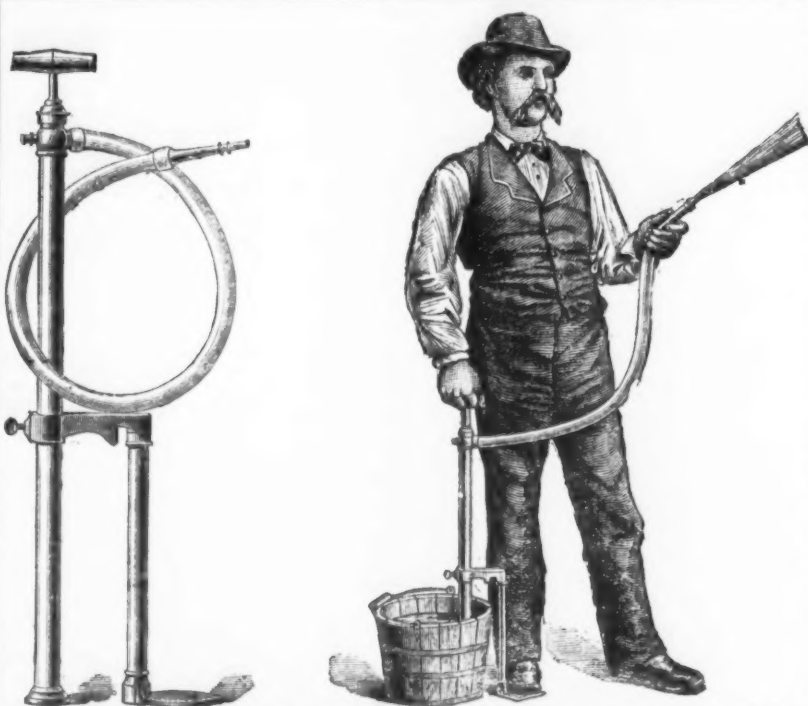


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enjoying the same. The prosperity, however, was not due to the national policy, but in spite of it. (Opposition cheers.)

Hon. Mr. Bowell said it was not his intention to follow the honorable gentleman in the details of his speech. If honorable gentlemen would agree as to what their policy was, it would be better for themselves and for the country. The member for Center Huron had said almost every manufacturer who had been protected was a highway robber. The member for Lambton had barked back a great deal since his speech in Dundee, when he was such an ardent free trader.

Hon. Mr. Mackenzie: No, I have made no change whatever.

Hon. Mr. Bowell said the honorable gentleman proposed now to lop off the branches of the tariff one by one, instead of cutting it down at one fell swoop.

Hon. Mr. Mackenzie: I never said so.

Hon. Mr. Bowell said if some export had decreased it was because there was a large consumption at home. Under the previous government the manufacturers had to send their products out of the country to get a market. The inter-provincial trade had almost doubled since the tariff had been in force, and the goods manufactured in Ontario and Quebec, if not sent abroad were sent to the Maritime Provinces and to the Northwest and Manitoba. This was proved by the fact that there was not a manufacturing industry in this country that was not working to its utmost capacity. A gentleman who had been a great free-trader in theory had recently, after traveling in the Northwest, told him that he had changed his views because he saw such a large quantity of Ontario manufacturers in that distant section of the country. He could admire Parnell when he advised his countrymen to purchase no goods except of their own manufacture, and was sure the people of this country would regard with disapprobation the advice given by the member for West Durham to the people of the Maritime Provinces to purchase their goods in the United States.

Hon. Mr. Anglin: I never said so. I was there.

Hon. Mr. Bowell: I don't know that that is an evidence of the fact. He (the speaker) promised to bring down the return asked for.

Mr. Charlton moved the adjournment of the debate. Carried.

Bituminous Coal and Iron Ore Statistics from the Census.

Professor Pumpelly, special agent of the Census, has submitted his preliminary report on the production of bituminous coal in the United States for the census year 1880. He shows the production by coal fields, in tons of 2000 pounds, as follows:

Bituminous:	
Appalachian Field	29,812,240
Western Field (Illinois, Indiana, &c.)	5,751,101
Michigan Field	100,806
Triassic Field (Virginia and North Carolina)	46,746
Iowa and Kansas Field	2,232,458
All Fields west of 10th Meridian	1,477,719
Total Bituminous	48,420,570
Anthracite:	
Pennsylvania	25,640,812
Rhode Island	6,176
Total Anthracite	25,646,988

Grand total of coal production of the United States for the year ending June 1, 1880..... 74,067,558

Grand total of hands employed in coal mining..... 170,585

The production of coal in England in 1880 was 146,812,122 tons of 2240 pounds. The number of collieries in England was 3880 and in the United States 3764. The acreage of coal land thus far discovered west of the 10th meridian amounts to but 33,001 acres. This is in California, Colorado, Montana, Oregon, Washington and Wyoming. Of the total, Colorado has 23,592 acres. The acreage of coal lands east of the 10th meridian available and attached to working establishments amounts to 410,642 acres. This acreage is divided up as follows: Alabama, 4995 acres; Arkansas, 81; Georgia, 16,028; Illinois, 55,051; Indiana, 10,407; Iowa, 20,128; Kansas, 1600; Kentucky, 34,635; Maryland, 15,112; Michigan, 107; Missouri, 3715; Nebraska, 1; North Carolina, 1200; Ohio, 58,639; Pennsylvania, 118,311; Tennessee, 23,743; Virginia, 230; West Virginia, 46,659. Pennsylvania produces 44,665 per cent., or nearly one-half of the aggregate production for the United States. The three leading States of Pennsylvania, Illinois and Ohio produce nearly three-fourths, and the eight leading States, Pennsylvania, Illinois, Ohio, Maryland, West Virginia, Indiana, Iowa and Kentucky nearly nineteen-twentieths of the entire product. The United States, exclusive of the territories, has gained 134.4 per cent. in weight of product. The average price per ton has fallen from \$1.99 to \$1.22 during the past decade. The price for 1870 was reckoned in paper dollars.

In commenting on the two great industries, coal and iron ore, the report mentions some interesting and curious facts. It appears as between the bituminous coal industry and the iron ore mining industry, the former takes from the earth a product worth 140 per cent. more, employs 205 per cent. more hands and 46 per cent. more capital, uses 161 per cent. more materials and pays 222 per cent. more wages. The increase in the tonnage of the iron ore mined during the census year is 136 per cent., and in that of bituminous coal 135 per cent. as compared with the census year 1870, showing that these two great divisions of mineral production keep pace with each other and are advancing nearly twice as fast as the production of anthracite. The reason for this is that in the former cases new fields are laid under contribution from time to time as railways are extended, whereas anthracite is restricted to its original area. Iron is mined in 135 counties and bituminous coal in 314 counties east of the 10th meridian.

Building a Furnace on an Ore Bank.
Curious things have heretofore happened in the course of the development of the Lake Superior iron district, but none more agreeably surprising than the recent episode in the history of the Champion Mine. The Champion Furnace was built by the Morgan Iron Company in 1867, and was destroyed by fire in 1874, the old walls standing until recently, when the Champion Iron Company, which succeeded to the ownership of a part

of the Morgan Company's estate, began taking them down. In removing the bottom stones of the foundation, it was discovered that the furnace had been built directly over a solid body of red hematite. It may be surprising to some people how the builders of the Champion Furnace could have laid its foundation walls upon a body of ore, and at the same time have been ignorant of its presence. The Marquette Mining Journal, however, is of the opinion that this was due to the fact that probably not more than half a dozen men, aside from the few miners then employed in the district, knew hematite when they saw it. At that time very little ore, other than hard red specular and a small amount of magnetic had been mined—in fact, no soft hematite pits had been opened, except at the Jackson and Lake Superior mines—and, consequently, it is not at all strange that the builders of the Champion Furnace did not recognize the character of the ground in which its foundations were laid. This last discovery, with those recently made by the Atlantic Iron Company, would seem to indicate large probabilities in this comparatively new field of production.

The Coke Trade in England.

Durham County, England, has for years been the greatest coke-producing district in the United Kingdom, several thousand ovens having been in constant operation, sending their products into iron-making districts at considerable distances. Yorkshire, Derbyshire and several other counties actively engaged in the production of pig iron formerly depended upon Durham for their coke supplies, this dependence, however, having gradually given way in favor of other coal-mining centers where coke has been extensively made for a number of years. Unfortunately, as regards the latter, but little attention was paid to the production of a fine quality of coke until within the past few years, when colliery owners found that it would pay them to make coke suitable for iron smelting in particular, so as to equal the quality of the Durham product, which, as the rule, has been of a good and uniform character. Nearly 5,000,000 tons have been annually turned out in the Durham district, part of this large quantity having been sent to different portions of the country. The cost of transportation in these instances has always been an important item to the purchasers, who, nevertheless, greatly preferred the coke to that produced in other counties. There are practically two zones of combustion in blast furnaces—one at the tuyeres and the other at the top of the furnaces, where the gaseous matter, acting on the oxide of iron, generates carbonic acid; this attacks the carbon in the upper zone, and the softer and more friable the coke, the more easily it is attacked and consumed, without performing any useful work whatever in the smelting operation. This shows a how essential it is that coke should be of a certain density, and consumers were consequently forced to satisfy their demand by resorting to the supply from Durham County, this coke being of a superior quality, and especially adapted for use in the blast furnace. In the West Riding of Yorkshire, as well as in other districts, the coke formerly made was of a decidedly inferior quality, but now the colliery owners have adopted the best appliances for turning out a superior article, and it has been found by grinding, picking and washing the coal that coke can be produced as good as the Durham. While this improvement has been going on, the Durham coke has rather deteriorated. Mr. Richards, who may be looked upon as an authority on the subject, not long since stated that it could not be denied that large tracts of the best coking coal in the county of Durham have been worked out, and although there was still a very large quantity of good coking coal left, yet some of the inferior seams were being largely worked, very little attention being paid to the clearing of the coals from these inferior seams. He also expressed the opinion that the coke was not generally so good now as it was a few years ago, and "this was proved by the increased quantity required per ton of pig iron made." The value of hard coke to the iron manufacturer has been shown to consist in a good deal more than its mechanical strength. The Durham coke is now finding a number of competitors, as may be seen from the fact that at the iron works in Lincolnshire, where it was extensively used a few years ago, it has been in a great measure superseded by that made in the West Riding of Yorkshire. In Derbyshire also a good deal of the latter is used for smelting purposes, but there is every reason to believe that the collieries in the county will fully provide all that is required by the ironmakers.

In South Yorkshire the seams of coal are well suited for coke-making, and during last year there was a considerable addition made to the number of ovens connected with several collieries, and in addition the best appliances, such as Shepherd's patent coal-washing machines, have been taken advantage of, so that makers assert that the coke will stand comparison with the best that is sent out of Durham. By crushing the coal into powder, and making it free from dress, good coke is the result, as the coal is well suited for the purpose. The trade is, therefore, getting more divided, and smelters look at the difference in the cost of carriage. The old beehive oven is still in favor, but different forms have been successfully introduced at several places, including a colliery belonging to the Barrow Steel and Iron Company. In Nottinghamshire, where some new furnaces have lately been blown in, it is probable that the coke will be made on the spot. During the past year efforts have also been made to save the ammonia and tar contained in the gases, previous attempts having shown that this could be done; the coke, however, was found to suffer much in quality, so that what was gained in one way was counterbalanced by a loss in another. Some recent experiments are said to have been more successful, so that there is every probability of the valuable products of the gas being obtained without injury to the coke. As it is, the making of coke for smelting iron in particular is becoming more general, so that ironmasters in several districts are now able to purchase it much nearer to their furnaces than they were formerly able to do, the quality being better and the cost less.

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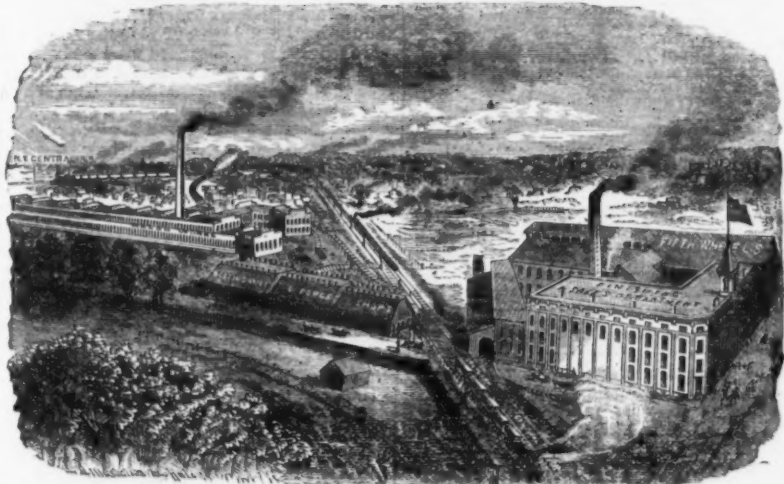
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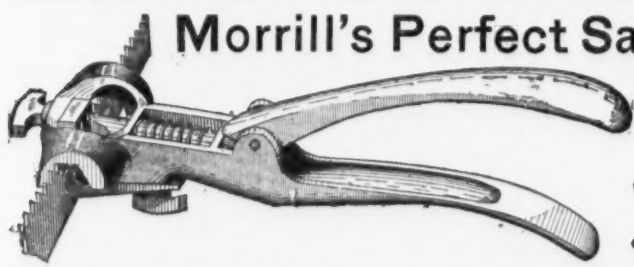
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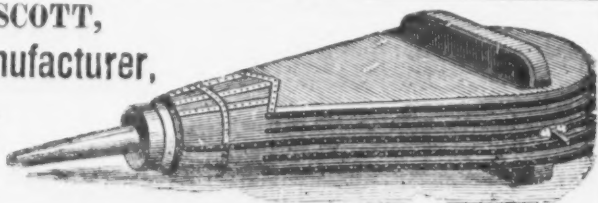
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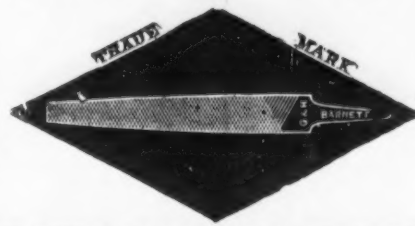
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Ginsaw,
Gulleting,
Half-Round,
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Hand Equaling,
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Handsaw Taper, slim,
High Back,
Hook-Tooth,
Knife,
Knife Blunt,
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Mill,
Mill Blunt,
Mill Pointing,
Pillar,
Pitsaw,
Reaper,
Roller,
Round,
Round Blunt,
Slotting,
Slim Handsaw Taper,
Square,
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Square Equaling Files,
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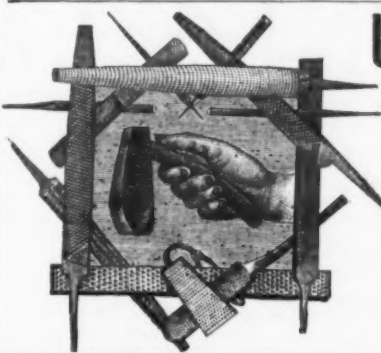
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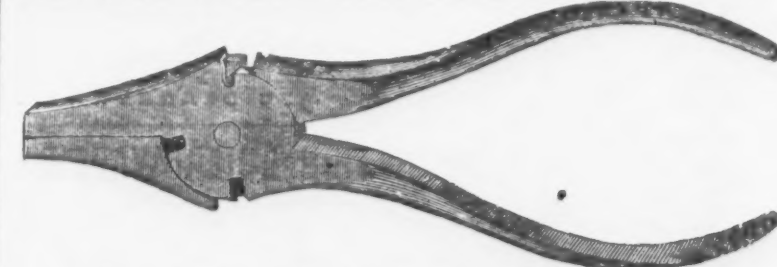
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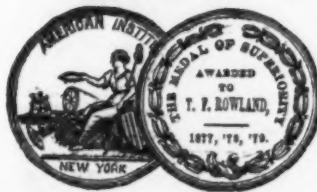
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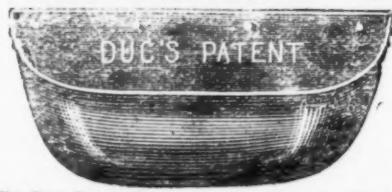
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This Bucket is struck out from the best charcoal iron; consequently is very durable. It requires 50 per cent. less power to run it than the old-fashioned square bucket, and will outwear half a dozen of them. Over 500,000 are now in use by the principal Millers, Brewers, Distillers and Manufacturers at home and abroad. It is the best Bucket made.

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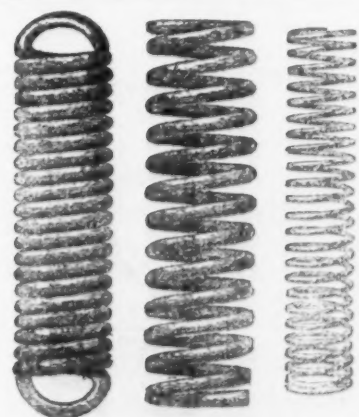
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Our Springs are used by the U. S. Government and various Meteorological and other Scientific Institutions.

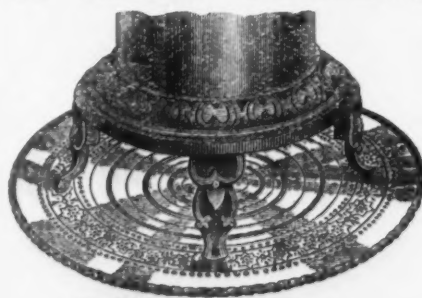
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ESSEX HORSE NAILS.

Hot Forged, from Norway Iron, Warranted Best Quality, Pointed and Polished.

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The Junk Business.

In a certain sense the world's prosperity may be said to depend upon the junk dealers, since they are the great purveyors for our paper mills. Our paper mills run our printing presses, and the press is among the foundations of our civilized prosperity. In New York City alone there are something like 200 junk shops, wholesale and retail. There are, in addition, about 1110 licensed junkmen, who go out with carts every day and collect refuse of various kinds from door to door. The number of unlicensed rag-pickers is estimated by the officers of the License Bureau to be at least 1000, a number which to an observer is manifestly much too small, since these rag-pickers, to all appearances, considerably outnumber the licensed junkmen. Some of the junk shops employ from fifty to eighty persons in collecting, weighing, sorting and packing the stuff, and, at a moderate estimate, at least 10,000 people in this city are dependent upon this business for their livelihood. It is a curious fact, but one which grows out of the necessities of the case, that the whole business is systematized to a degree quite marvelous to an outsider. Every description of pasteboard, rag, bottle, waste paper or piece of old metal has its fixed price. In some of the large junk shops of this city there are no less than seventeen grades of wares, differing in price perhaps by $\frac{1}{8}$ of a cent per pound. In paper stock there is, for example, No. 1 white, which means the trimmings and clippings of white paper made from rags. These are mostly obtained from the bookbinders, and are worth 3 cents per pound. Then comes No. 2 white. This embraces circulars, spoiled sheets and other similar kinds, and is worth only $2\frac{1}{2}$ cents per pound, and so on, the prices going down to the heavy brown paper made from ropes and book covers, that are worth only from $\frac{3}{4}$ to $\frac{1}{2}$ cent per pound. Old tin, rags, bottles and every description of junkware has the same system of subdivision and succession of prices. By force of experience the weighers in these shops recognize instantly the quality of the stuff they are buying, and call out at once to the cashier whether it is one or two-cent stuff, or whatever it is worth.

It is only in rare cases that the junk man or rag-picker drives a hard bargain or quibbles over the fraction of a cent a pound. As a rule, he makes no demur at the prices assigned. The most valuable stuff is the old garments, the cloth of which, after being unseamed and ripped, is worth from 10 to 15 cents per pound to the shoddy men. A junkman who has a lucky day and finds plenty of old cloth and rags, good bottles and the best sort of paper, it is said will be able to make from \$4 to \$5. A wet day, however, will greatly diminish the profits. The bulk of the junkmen are said to be Irishmen, though there are a goodly number of Germans in the business. The unlicensed rag-pickers seem to be mostly Italians. They certainly form an immense colony in Crosby and Mulberry streets. They collect from the dumps and ash barrels what the other and more high-toned rag-pickers would leave behind. The stuff collected by the Italians is said to be so filthy that most of it has to be washed before it can be sold. So dirty, indeed, is this junk that the best dealers do not like to accept it from them, because the manufacturers declare it to be too dirty. The business is an apparently lucrative one, as rumors are current of junkmen being worth anywhere from \$50,000 to \$200,000, who still attend to the details of the business. The business in bottles and in sheet metals is large, the latter going to the wire manufacturers. Scarcely a medicine bottle is thrown away, most of them being washed out and restored to the trade as new. An east side bottle dealer has a monopoly of this business. The Italians sell the grease and fat that they pick up to rendering establishments, and it is hinted that much of it reappears as lard. The bones may be either ground for manure, or the large ones cut up for buttons and other similar purposes. Old hats are stripped, recovered, reopened, and the east side manufacturer who buys the hat from the rag-picker for 10 or 15 cents resells it in rejuvenated shape for \$1.50 or \$2. Old shoes are worth anything from 5 cents upward, and go to the Baxter street shoemakers, who use them as far as possible in making up their new shoes that they sell for \$1 per pair.

At one time old newspapers were in great demand at the paper mills, but so much paper is now made from wood, straw, clay, salt hay, &c., that their price has gone down very much. Their principal value, at the present time, is for packing purposes, and for this they must be flat and in comparatively good condition. At the present time, when sold simply as junk, they bring about 1 1/2 cents per pound. When the Mechanics' Bank, at one time, sold out 50 years' accumulation of old ledgers, checks, letters, drafts, &c., \$1900 was paid for the collection, yet the same man who bought the \$1900 lot from the big bank is ready to deal with the boy bringing in a pound lot of similar goods which, at the market rates, would bring just one cent.

The newspapers tell remarkable stories about lucky finds made in refuse heaps by junk dealers and their employees; how on one occasion the papers relating to the secret correspondence between Jerome Bonaparte and Miss Paterson, of Baltimore, and the subsequent negotiations by the Bonaparte and Paterson families, were found in the waste paper of the old warehouse of the bride's father. In this strange manner the entire history of this interesting affair was said to have been found, and formed the subject of a book published seven or eight years ago. A Maiden Lane jeweler who lost a diamond ring, had it returned to him by the man to whom he sold his waste-paper stock. The letter from the jeweler expresses thanks, and is often shown by the dealer. Another case is mentioned where indorsed checks to the amount of \$3000 were found among the waste paper of a well-known city bank, and it is said that the owner, unaware of his loss, had not stopped payment, and the checks would have been paid had they been presented. Penknives, postage stamps, scissors, &c., are among the daily finds. Money, however, they say comes rarely. Hard cash is about the only thing that people will take the trouble to thoroughly search for when it disappears.

All sorts of queer things find their way into the junk shop, and autographs and other things of the kind form no small portion of the foreman's pickings. Some junk shops make a regular business of old sewing machines. The price at the present time, however, is very low, 75 cents, we believe, being about the highest rate, though we think they have been paid as high as \$1.50.

Hyde's Improved Centering Machine.

Fig. 1 of the accompanying illustrations gives a general view of a new and improved centering machine recently introduced by the George Place Machinery Agency, No. 121 Chambers street, New York City, which has several valuable features that distinguish it from other machines of the same general character. Fig. 2 is a detail of the centering chuck, and so clearly shows the principle upon which the device is constructed that a brief description will suffice.

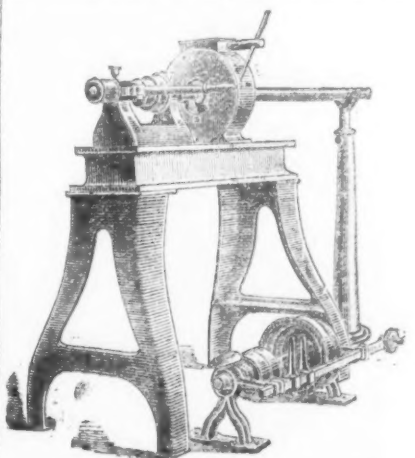


Fig. 1.—General View, showing the Adjustable Forked Rest.

The jaws, which are of hardened steel, are $2\frac{1}{4}$ inches wide by 1 inch thick, and are pivoted as shown in the engraving. They are operated simultaneously by the fixed screw at the top, which, by means of the movable nut, gives motion to a ring inside of the case that communicates with each of the jaws by means of studs suitably fitted. The jaws open sufficiently to admit shafts up to $4\frac{1}{2}$

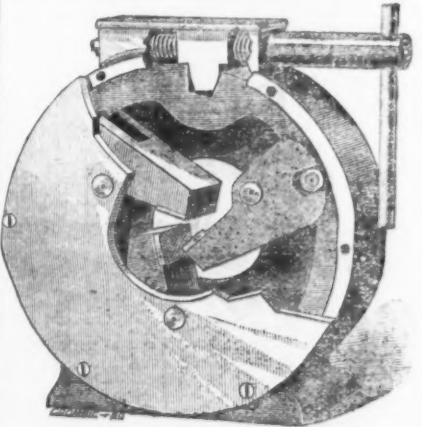


Fig. 2.—Enlarged Detail Through the Centering Chuck.

inches in diameter, and fit accurately on diameters as small as $\frac{1}{8}$ inch. The spindle which carries the centering drill is of steel, and is moved forward and backward by means of a hand lever, and, being feathered, revolves with the cone. This lever, instead of working directly with the rack, communicates motion to it by means of a pinion interposed between the two parts. By this means the spindle is operated by a pulling instead of a pushing motion, which is a desirable improvement over many of the tools in existence. The floor stand has a wide base and is substantial in construction. The rest for sustaining the end of the shafting being centered, is adjustable as to height. The materials employed and the construction are of the best, and the manufacturers do not hesitate to fully guarantee the tool.

A case that is being regarded with much interest in the coke region is occupying the attention of the Fayette County courts. It is the case of David Torrence against Cochran, Keister & Co. Torrence is a farmer whose land adjoins the coke furnaces operated by the Abam Company, and he has brought suit to recover damages which he claims his property has sustained by the presence of the coke works. He alleges that the smoke from the ovens has so affected the surface of his land as to greatly diminish its productiveness for agricultural purposes. He claims, for instance, that not only is his grass crop made lighter, but even that which does grow is so vitiated that the effects of the smoke and soot are perceptible in the milk and butter that come from the cows which graze on his farm. He lays his damages at \$5000. The case has been in progress some days and a verdict has probably been reached. The result is watched with much interest, since it is a test case. If the plaintiff should win it would likely open the way for a large amount of litigation, as the clouds of smoke that settle down over that region have been the source of much annoyance to farmers.

Several of the main streets of Vienna have been illuminated by means of the Brush electric light since the beginning of January. The illumination is only a temporary arrangement in order to test the efficiency of the system, and the company will receive in return an amount of money equal to the cost of the gas lighting during the course of the experiments. There are 14 lamps, of 2000 candle-power each, supported by columns some 16 feet high and about 131 feet apart. The current is transmitted through a copper wire, 3.5 mm. in diameter (about 14 inches), and the illumination is said to give entire satisfaction.

RUSSELL & ERWIN MANUFACTURING COMPANY,

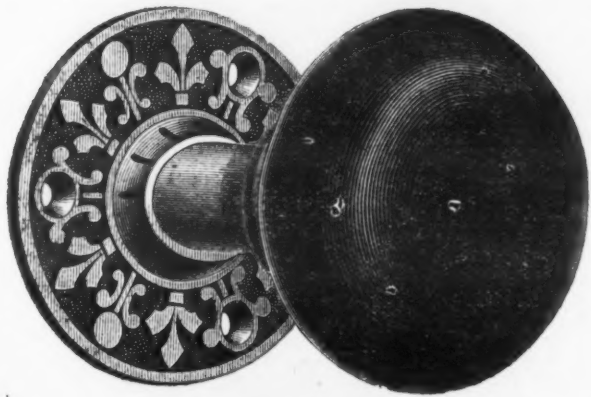
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Manufacturers of **BUILDERS' AND OTHER HARDWARE,**
IRON AND BRASS WOOD AND MACHINE SCREWS.

MANUFACTURERS' AGENTS AND DEALERS IN GENERAL HARDWARE AT OUR

WAREHOUSES: NEW YORK, 45 & 47 Chambers St.; PHILADELPHIA, 425 Market St.; BALTIMORE, 17 South Charles St.; LONDON, 47 Upper Thames St.

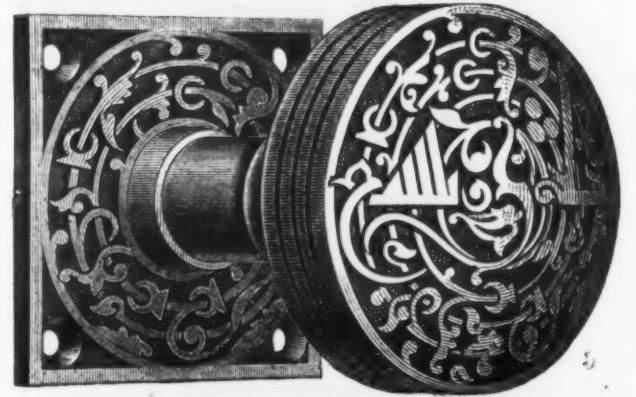
DOOR KNOBS.



Nos. 8850, 9850.



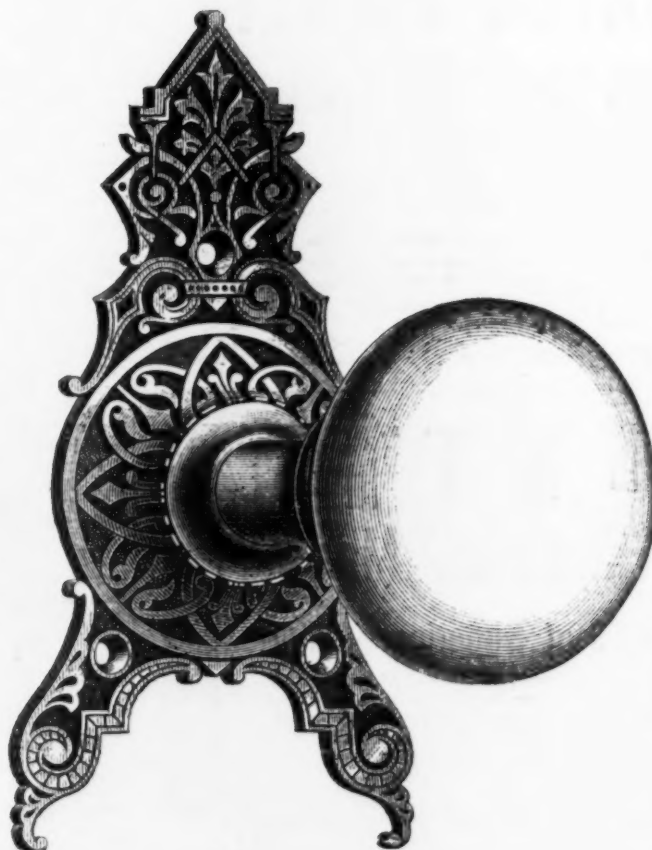
No. 700.



Nos. 8020, 9020 and 938.



No. 8851.



No. 701.



No. 939.



No. 935.

SHUTTER KNOBS.



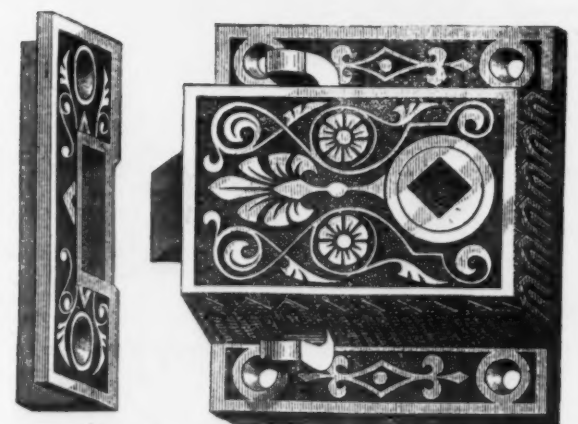
Nos. 32, 33 and 8032.



No. 37.



No. 252.



Screen Door Latch, Nos. 8500, 8501.



Store Door Handles, Nos. 8001, 8002.



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BEST QUALITY CARRIAGE MAKERS' HARDWARE.

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Terms, Cash, within 60 Days.

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HARTLEY & GRAHAM, 17 & 19 Maiden Lane, NEW YORK,

Agents for the "ROBIN HOOD" REVOLVERS.

STEEL BARREL AND CYLINDER.

22, 32, 38 and 41 CALIBRE.

22 Cal., Short or Long Cylinder.

Wood, Rubber Ivory and Pearl Handles.

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Plain Finish, Engraved or Enameled.

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Plain or Saw Handle.

Plain Finish, Engraved or Enameled.

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Manufacturers of Copper, Brass and Iron Rivets; Common and Swedes Iron, Leathered, Carpet, Lace and Gimp Tacks; Finishing, Hungarian, Trunk, Clout and Cigar Box Nails, &c. Rivets made to order.

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165 GREENWICH STREET.

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Purposes. Manufactured by

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Malleable Iron and

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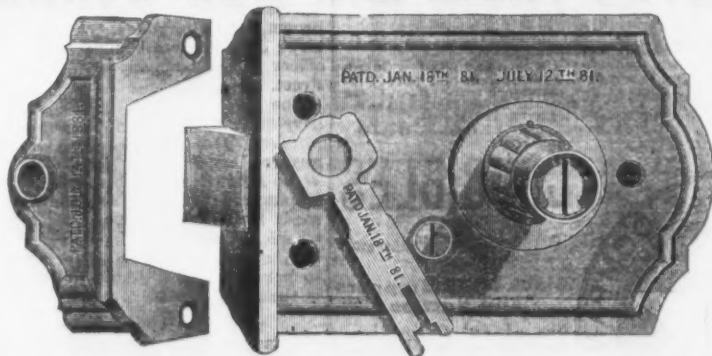
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Patent Applied For.

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BARNES' NEW RIM NIGHT LATCH.



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Manufacturers of



THE FAVORITE POCKET WRENCHES

Made both of best Malleable Iron and Cast Steel tempered in Oil. Two sizes, 4 and 5½ inch. Also manufacturers of the "Baldwin" Plane Irons and a full line of Socket Firmers and Framing Chisels, Socket Gouges, Cleavers, Draw Knives, &c. Catalogue and discounts to the trade.

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SOCKET WRENCH

For carriage use it has no equal.

In its use there is no wearing of

nuts. No greasy fingers. No nuts

dropping into dirt. No necessity of

having a close wrench for each car-

riage. All owners of carriages or

wagons will find in this an article

which will prove satisfactory in every

particular. Are made of best malle-

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"COMMON SENSE" MOUSE TRAP.

BEST IN MARKET.

For Home & Export Trade.

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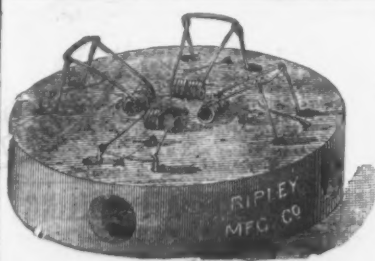
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Manufacturers of

Porcelain-Lined Lemon Squeezers, Mallets, Rose-

wood Faucets, Patent Boot Jacks and Hard-

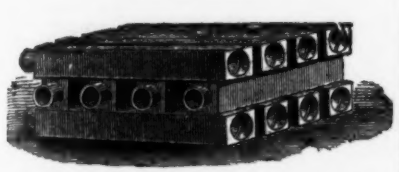
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G. F. Warner & Co.'s Carriage Clamps.
DEPOT FOR
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A. Field & Son's Tacks, Brads, Nails, &c.
Nicholson File Co.'s Files and Rasps.
W. & S. Butcher's Chisels, Gouges, Plane
Irons and Cleavers.
E. W. Gilmore & Co.'s Strap and T Hinges.
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Also a general assortment of Hardware.

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COTTON AND BALE HOOKS,
Patented Feb. 13, 1877; a new combination of Hooks.
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F. R. EMMONS,
TACKS
Manufactured by
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The Patent Combined
Dinner Pail and
Lantern.
The most perfect Dinner Pail
in the world. Box office for
dinner and a Lantern at night.
Manufactured by J. S. HAIGHT,
PORT CHESTER, N. Y.
Sent by express on receipt of
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Keystone Screw Co.
17th and Fenango Streets,
PHILADELPHIA.
J. BILLERBECK,
Manufacturers of
Iron Gimlet-Pointed Wood Screws
W. & J. TIEBOUT,
Manufacturers of
Brass, Galvanized & Ship
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Vulcanized Rubber Fabrics
ADAPTED TO
MECHANICAL PURPOSES.
RUBBER BELTING and PACKING.
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Steam Packing,
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Belting,
Steam Hose,
Piston Rod
Packing,
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Wagon Springs,
Gas Tubing,
Machine Belting,
Wringer Rolls,
Billiard Cushions,
Grain Drill Tubes,
Emery Wheels.



This company manufactured the immense DRIVING and ELEVATOR BELTS for the Buckingham Elevators at Chicago, which have been running perfectly for more than Twelve Years, also those for Armour, Dole & Co., Chicago, and Vanderbilt's great elevators of the New York Central and Hudson R. R. New York, being the Largest Belts in the World! We are now making an Elevator Belt 36 inches wide and 2,500 feet in length, which will weigh over 18,000 pounds.

LINEN and COTTON HOSE.
Pat. 645. Plain and Rubber Lined. Pat. July, 1873.
Circular Woven-Seamless Antiseptic RUBBER LINED "CABLE" HOSE and "TEST" HOSE, Vulcanized Para Rubber and Carbolized Duck, for the use of Steam and Hand Fire Engines, Force Pumps, Mills, Factories, Steamers, Ships, Hospitals, &c.
"TEST" HOSE. "CABLE" ANTISEPTIC

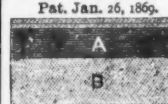



Emery Wheels and Packing.
Patented. ORIGINAL Patented.
Solid Vulcanite EMERY WHEELS
Emery Wheel. LARGE WHEELS MADE ON CAST-IRON CENTER IF DESIRED. Section of Emery Wheel showing Iron Center.


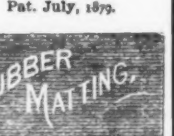



The properties of these Wheels are such that they can be used with great advantage and economy for cutting grinding, and finishing Wrought and Cast Iron, Chilled Iron, Hardened Steel, Slate, Marble, Glass, &c. These wheels are extensively used by manufacturers of Hardware, Cutlery, Edge Tools, Plows, Saws, Stoves, Fire Arms, Wagon Springs, Axles, Skates, Agricultural Implements, and small Machinery of almost every description.

PATENT ELASTIC
Rubber Back Square Packing
BEST IN THE WORLD.
For Packing the Piston Rods & Valve Stems of Steam Engines & Pumps.
B represents that part of the packing which, when in use, is in contact with the Piston Rod.
A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam tight and yet creates but little friction.
This Packing is made in lengths of about 20 feet, and of all sizes from 1/4 to 2 inches square.




Corrugated Rubber Mats and Matting,
Pat. 11,308, 213,601. For Halls, Flooring, Stone and Iron Stairways, &c. Pat. July, 1879.
RUBBER MAT This practical and indispensable article—especially for wear where exposed to ice, snow or slush—was first introduced by this company several years ago, and its real value is in being almost indestructible, when proper materials are used in its manufacture, whilst the cheap, inferior quality forced on the public by reckless imitators of our patent goods soon becomes brittle and crumbles to pieces. Address:
NEW YORK BELTING & PACKING CO.,
Warehouse, 29 Park Row, New York.
JOHN H. CHEEVER, Treasurer.
H. P. GREGORY & CO., San Francisco, Cal., General Agents for Pacific Coast.

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Shank, Socket Firmer and Socket Framing Chisels,
PLANE IRONS.
CAUTION.—Buyers should be on their guard and not have inferior goods palmed on them by unprincipled persons, who represent them as our make. Our tools are stamped "BUCK BROTHERS," and our labels have on our trade-mark, also "Riverlin Works."



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The Phosphor-Bronze Smelting Co.,
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Owners of the U. S. TRADE MARKS Sole Manufacturers of Phosphor Bronze in the United States.
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THE STRONGEST, TOUGHEST, BEST AND MOST DURABLE METAL.
PHOSPHOR BRONZE SPRING WIRE AND WIRE FOR WEAVING, &c.
Pump Rods, Tubes, Screws, Jack Chains,
Rolled Bolts, Nails, Wire Cloth, Sash Cords,
Sheets, Boat Nails, Pens, Wire Ropes,
Plates, Tacks, Sash Chains, Cast Kettles.
INGOTS FOR CASTING.
Send for Pamphlet and Price Lists.
PHOSPHOR-BRONZE.

1, 20 feet bosh and 75 feet high, for four weeks ending February 18, was 4850 tons of 2240 pounds each—about 173 tons every 24 hours; consumption of coke 11-10 tons per ton of iron.

The Westinghouse Machine Company have just completed three of their high-speed engines, and have twenty-five others in process of construction. Of those completed, one is for the Cleveland Electric Light Company, another for the Edgar Thomson Steel Works, and the third for the steel works of Hussey, Howe & Co. The first one is of 10 horse-power, and will run at 900 revolutions per minute. It is coupled directly to an electric generator, and the whole is mounted on a wagon made for the purpose, it being the design of the company for whom it was made to furnish light for shows, picnic parties, &c. The engine for the Edgar Thomson Steel Works is of 50 horse-power, will make 300 revolutions per minute, and is intended to drive an electric-light apparatus. That for Hussey, Howe & Co. is of 100 horse-power, will make 300 revolutions per minute, and is intended for a roll train, with which it will be directly connected. The engine that drives the machinery of the Westinghouse Machine Company's Works is running regularly 500 revolutions per minute, is of 15 horse-power, and occupies a floor space of 24 x 30 inches. Another small engine may be seen in the works which is capable of making 1100 revolutions per minute, and is of about two horse-power. Engines of this class and size are designed to run head-light electric machines for locomotives. The company have orders three months ahead for their specialties, and have erected on the corner of Liberty and Twenty-fifth streets, opposite their present works, a 75 x 100-foot iron-clad building, with floor and gallery, which will be supplied with appliances for doing heavy engine work. They expect to have this addition to their plant in operation in about three months.

VIRGINIA.
A connection railroad from the Richmond, Fredericksburg and Potomac to the Richmond and Alleghany has just been opened, shortening the distance 11 miles between the James River Valley, which is traversed by the Richmond and Alleghany and the North. This connection road, known as the "Henric Branch," runs throughout its length through a developed coal field, well known to geologists and to coal men generally, but one that has suffered because until now there has been no railroad communication.

Wythe Furnace has been sold for \$21,000.
WEST VIRGINIA.
The Kroman Iron and Steel Company, at Moundsville, are about to start up their bar mill.
Fire was discovered on the roof of J. H. Hobbs, Brockunier & Co.'s glass factory, in South Wheeling, about five o'clock on the evening of the 24th ult. It had caught from the pipe passing from the "glory hole," and owing to the scarcity of water soon spread over the entire factory. The ventilating shaft gave a tremendous draft, and the fierce heat of the flames melted the braces supporting the iron roof. The factory with the mold and pattern shops were totally consumed. The molds and presses were saved; but the patterns were either consumed or got damaged so as to be useless. The furnaces are still standing and intact, and workmen are keeping up the fire in them so that the pots will be saved. The cutting room and packing shop, which were separated from the factory, were saved. The building destroyed was about 250 x 100 feet. The firm place the loss at from \$20,000 to \$30,000, fully covered by insurance, mostly in foreign companies. A large proportion of the loss is on manufactured glass. This was the oldest glass factory in operation in the West, and employed about 500 men. The firm will put up temporary sheds, and expect to be making glass again this week.

KENTUCKY.
Aiken & Drummond, of Louisville, are having a very heavy demand for their molding machine, and have been compelled to enlarge the capacity of their works. Their trade is very extensive, their machine now being in use in England and Belgium, as well as this country.
Ashland Furnace is still running regularly, making about 400 tons per week.

TENNESSEE.
J. P. Drouillard, R. B. Stone, Wm. A. Goodwyn, Edgar Jones and V. L. Kirkman have applied to the County Court Clerk of Davidson County for a charter of the "Drouillard Iron Company." The object of the incorporation is to greatly enlarge the facilities for turning out iron at Mr. Drouillard's furnace on the Cumberland River.
The Tennessee Coal and Railroad Company will this week take charge of its recent purchase, the Southern States Coal, Iron and Land Company. The company will put Furnace No. 2, at South Pittsburgh, in blast this month. Work is now completed on it and all preliminaries are ready. The company will also erect a fourth furnace at Cowan. The car shops and foundries at South Pittsburgh will at once be considerably enlarged and their capacity greatly increased.

ALABAMA.
The Birmingham Iron Age of the 7th ult. says that W. H. Woodward, of LaBelle Unit and Iron Works, Wheeling, W. Va., has bought 743 acres of land in Possum Valley, eleven miles from Birmingham, and that the company named will at once erect on the property a blast furnace 15 feet bosh and 60 feet high. The contract for the furnace and machinery has been let to Stokes & Parrish, of Philadelphia.
OHIO.
We learn that A. Ball & Co., Canton, have entered suit against Bucher, Gibbs & Co. for \$15,000 damages for libel. Both firms are plow manufacturers in that city, and the suit grows out of a dispute concerning the names of their respective plows.
It has been determined to rebuild the Brilliant Glass Works, at Brilliant, on the site of the building just destroyed. The stack and furnace remained intact at the time of the fire, and the latter was full of glass. Forty workmen have been set to work clearing up

the debris and preparing for the erection of the new building, which is to be under way within three weeks.

The Youngstown Manufacturing Company are at present at work on an order for 24,000 car bearings for an establishment in Columbus.

There is a rumor that Peter Hayden, of Columbus, has purchased and will take immediate possession of the Capital City Car Works, and will continue the business.

At the Fulton Mill, Cincinnati, Mr. Danks is putting down more of his rotary puddling furnaces.

The Newburgh Furnace Co., Cleveland, which recently purchased the old Emma Furnace in the Eighteenth ward have elected the following directors: Messrs. J. H. Dal-liba, W. G. Pollock and Dudley Baldwin, Cleveland; George D. Wick, Chicago; C. M. Schmick, Leetonia.

Heald & Conroy, proprietors of the Link and Pin Works, Warren, have dissolved partnership, Mr. Heald taking charge of the works. Mr. Conroy will erect similar works at Youngstown.

The Niles Tool Works, Hamilton, shipped last month a set of pulley bearing and turning machinery to St. Petersburg, Russia.

J. H. Watt & Bros., of Barnesville, manufacturers of Watt's patent self-rolling car wheel, have dissolved partnership, and the firm will hereafter be known as the Watt Mining Car Wheel Company.

Mr. D. M. Steward, of Cincinnati, is filling some large orders from Boston, New York, Chicago and nearer home for his new insulators for gas burners lighted by electricity, and expects a heavy trade for these and insulators for electric wires attached to buildings.

The Queen City Malleable Iron Company's Works, at Cincinnati, are running to their full capacity under the new management. They have recently added to their list of hardware specialties some new articles, among which are their malleable wheels and carriage shaft attachments. In these goods are combined great strength and tenacity, with lightness and beautiful finish. They will soon present other new specialties to the trade.

The Cincinnati Screw and Tap Company have recently removed to the large building at the corner of Pearl and Plum streets, where they have very largely increased the facility of their works. Mr. Geo. A. Mueller and Mr. Fred Holz are the proprietors. They have been in operation for several years at Cincinnati, and for some time the old works have been too limited for the increasing demand for their goods. They anticipate a very heavy trade this year, and have added some new and improved machinery, doubling their shop facilities.

The American Bolt and Screw Case Company, manufacturers of patent revolving bolt and screw cases, at Dayton, are prepared now with their additional facilities for the manufacture of screw and bolt cases to more than double their production. They have recently filled some good orders from hardware jobbers of Philadelphia, Baltimore, San Francisco, St. Louis, Pittsburgh and Detroit, and have a number of large orders yet unfilled. They anticipate an increasing trade for these cases this year, and will offer in a short time some new and beautiful designs of cases suitable for retail hardware stores and for carriage manufacturers and machinists.

ILLINOIS.
The Chicago Die and Machine Company are working up quite a trade for their car-wheel grinding machines, having recently shipped three—one to the Pullman Palace Car Company, Pullman, Ill.; one to the Le-high Valley Railroad, and the other to the Baltimore and Ohio Railroad.

Harrington & Oglesby Company, of Chicago, manufacturers of perforated sheet metals, will shortly erect for their own use a factory 100 x 150 feet and three stories high. This will more than double the present capacity of their establishment. They are operating their works day and night, and are two months behind in their orders.

The main building of Fowler's spike works, at Englewood, is finished, and it is expected the works will be in running order, on an initial capacity of twenty tons a day, by the 15th of March. Most of the machinery is now in place. The Congdon Brake Shoe Company, who purchased of Mr. Fowler 300 x 125 feet adjoining the spike works on the south, have finished the erection of a large machine shop and foundry, and expect to be in operation in twenty days with a large force of men.

The Columbian Brass Works is the name of a new concern recently established in Chicago for the manufacture of brass castings of all descriptions.

The Chicago Steel Horse Shoe Company and Drop Forging Works, of Pullman, have added new and extensive machinery to their works for making all descriptions of drop forgings. Their specialties will be agricultural, carriage hardware and miscellaneous forgings; also railroad track and all kinds of wrenches. Mr. H. T. Russell, an experienced drop forger, is the superintendent of the works and was formerly with the Pratt and Whitney Company, of Hartford. This is the first establishment of its kind in this locality and will supply a long-felt want.

J. S. Lizars & Co., Chicago, have received the contract to place their patent feed water heater and purifier upon all the boilers at the water works and the Cook County Court House, in addition to which they have shipped several more to Springfield, Ohio, and Rochester, Minn., during the past week.

MISSOURI.
One of the boilers in the blooming mill of the Vulcan Steel Works, St. Louis, exploded with great force on the 23d ult., killing four men and injuring a number of others. The mill was also considerably damaged.

MICHIGAN.
We hear that Mr. C. Sprong, of C. Sprong & Co., owners of the Florence Furnace, has bought the furnace of C. J. L. Meyer at Fond du Lac, and will assume the management. He retains his interest in the old firm.

Leland Furnace, belonging to the Leland Iron Co., blew in last month after making extensive repairs. She will run on car wheel iron.

The Iron Age

AND
Metallurgical Review.

New York, Thursday, March 2, 1882.

DAVID WILLIAMS . . . Publisher and Proprietor.
JAMES C. BAYLES . . . Editor.
JOHN S. KING . . . Business Manager.

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The cable brings the intelligence of the failure of the negotiations for the treaty of commerce between England and France. It seems that M. Tirard, the French Minister of Commerce, has been opposing the concessions which the English Commissioners were instructed to demand from the French Commissioners before concluding the terms of the treaty. This opposition of M. Tirard caused the negotiations to be broken off, and all hope of a treaty being consummated in the near future is ended. The present treaty expired in February. This is another blow to the hopes of the followers of Cobden, and

shows how the shrewdest men may be mistaken. When Cobden secured the repeal of the corn laws in 1845, and later brought about a certain kind of free trade, and when he had persuaded the French Emperor to negotiate the commercial treaty just expired, he thought the world was on the way to free trade, and died happy in that belief. Now the drift is the other way. A respectable portion of Englishmen are agitating for a number repeal of the corn laws, and demand protection under the guise of reciprocity; the nations of Europe tend to protection, and the treaty Cobden so shrewdly negotiated with France is ended. Some men build better than they know, but it must be said of Cobden that he thought he builded better than he really did.

Steel Blooms.

The text of Secretary Folger's ruling in the matter of steel blooms is given in the letter of our Washington correspondent. It will be read with rather more of interest than of profit, and the reader who has any previous knowledge of the subject will reach the conclusion that Judge Folger made a mistake when he undertook to sustain his ruling by an argument. It would have been wiser if he had avoided nice distinctions and definitions of commercial terms and made his decision arbitrary, or because he believed that 45 per cent. was as high a rate of duty as blooms ought to pay. The closer we follow his reasoning the more clearly we perceive the depth of his misunderstanding and the comprehensiveness of his misapprehension. His whole argument to show that a bloom is not an ingot and cannot be so considered in tariff interpretation is upset by the simple fact, well known and established by incontrovertible evidence, that when the tariff was framed what we now call a bloom was called a clogged ingot. The name has changed, but the article to which the name "bloom" is applied remains unchanged. Judge Folger cannot believe that the framers of the tariff, when they fixed the duty on ingots fresh from the mold at 2½ cents per pound, intended that clogged ingots—a product one step further advanced toward finished rails—should by any subsequent misconstruction of the law come in at 45 per cent. ad valorem—much less at 30 per cent. And yet he expresses regret that respect for the decisions of his predecessors in office restrains him from declaring that 30 per cent. is the proper duty for blooms. That his argument has even the appearance of reasonableness rests upon an accident—the substitution of "steel bloom" for "clogged Bessemer ingot" in commercial nomenclature. If this principle is to govern Treasury decisions, it would be an easy thing to make the tariff inoperative, as it would not be a difficult matter to change the name of any product of iron or steel if the leading houses in the trade should set about it systematically. A very few years' use would give the new name the sanction of general employment.

The question we are discussing is not now, and has not been at any time, whether steel blooms—the "clogged ingots" of 1861—ought to be taxed 2½ cents, or 45 per cent., or 30 per cent. This is a matter for Congress to determine, and without disrespect to the Secretary of the Treasury, we may say it is none of his business whether the rate fixed by Congress is higher or lower than a given article ought to bear. Judge Folger evidently thinks that 45 per cent. is quite enough duty for steel blooms, and has set his wits to work to find reasons for so ordering. In this he has failed signally, and, as we have already said, an arbitrary decision would have done him more credit than his argument, and amounted to exactly the same thing in the end.

The Institute of Mining Engineers.

The annual meeting of the Institute of Mining Engineers, held last week in Washington, was one which those so fortunate as to be able to attend it will remember with satisfaction. The meeting was not conspicuous for scientific interest, but the papers were varied, and all dealt with topics of current importance. The discussion was free and animated, and while not developing any new or startling facts in science, was instructive and interesting. The discussion on tests of iron and steel as structural material, which is very fully reported elsewhere, is of immediate and practical interest in view of pending legislation, and expresses very freely the views of engineers and manufacturers of iron and steel as to the necessity of continuing the work begun by the United States Commission, which expired, by the failure of Congress to make an appropriation to meet its expenses, about the time the great testing machine now at the Watertown Arsenal was finished. The importance of creating a new commission with larger powers and better defined objects, has been brought to the notice of Congress in a bill just introduced, which will receive the hearty support of the entire profession, and we think have favorable consideration by both Houses of Congress.

To devote an entire session to memorial addresses in memory of the late A. L. Holley was a graceful tribute to one whose connection with the Institute added so much to its influence, usefulness and popularity. It was not an occasion for the display of brilliant rhetoric, nor for attempts at oratorical effects, but a gathering of those who knew and loved Holley, and as one friend after

another rose and paid tribute to his memory, there were many evidences of deep feeling, and few listened without tears. We cannot this week publish the proceedings of this session, owing to the pressure of other matter upon our columns, but hope to do so in our next issue.

In view of the interest of the city and the many places which members were naturally inclined to visit, such as the public buildings, the Corcoran Gallery, the Smithsonian Institution, the Navy Yard, &c., no excursions were arranged, and each employed his time between the sessions as pleased him best. An informal reception was given by President Arthur at the White House, which most of the ladies and members attended. The banquet at Wornley's on Thursday evening was one of the finest ever spread for the Institute, and the several distinguished guests who responded to toasts made this portion of the entertainment unusually brilliant. Altogether it was a pleasant meeting, though many felt it to be a sad one.

It is expected that the next meeting will be held in the far West, partly because many Western members desire such an opportunity to visit the Rocky Mountain region, and partly as an accommodation to members in the mining districts of Colorado, Arizona, Nevada, California and other far Western States and Territories, who have hitherto been required to come long distances to attend the meetings.

The Institute is rapidly growing in numbers and influence, and its active membership somewhat exceeds 1000. The election of Mr. R. P. Rothwell, E. M., to the presidency for the ensuing year, was a graceful recognition of his efficient services in organizing the Institute in the face of difficulties which to one less interested in the good of the profession would probably have seemed insurmountable. Probably the Institute has much outgrown Mr. Rothwell's brightest expectations, but this is all the more creditable to its founders, as so great an Institute could have been built up only on a foundation wisely laid.

The Dominion Budget.

The annual budget of the Dominion Minister of Finance was presented to Parliament last Friday, 24th ult. The policy of the present ministry is vigorously defended, the prosperity which the country now enjoys being referred to as evidence of its success. As interpreted by the opposition press, the Minister does not consider Providence as entitled to any thanks on this score. At no former period has public credit stood so high, there being no deficit in the treasury, as some had predicted, but, instead of this, an estimated surplus of \$4,132,700. It is contended, therefore, that the Government to-day stands in an impregnable position with respect to the results of the tariff, both for protection and revenue purposes. A number of changes are proposed. Brass in sheets and britannia metals in pigs and bars are placed in the free list, also quicksilver and spelter in blocks and pigs. The removal of the duty on tin means a loss to the treasury of \$100,000, but it is found necessary to encourage the canning industry. The duty on glass is increased to 30 per cent., also that on manufactures of lead. Iron it is proposed to reduce to \$1 per ton. Says Sir Leonard Tilley: "The question of the iron duties has been pressed upon the Government, and recently. The iron industry is an important one, no doubt, but at this moment we are not prepared to submit any further proposition regarding it, and I can only say in addition, with reference to it, that 'the subject is for the present under consideration.' Clock springs, now 35 per cent., are to be reduced to 10 per cent.; wrought-iron tubing, 1½-inch and upward, is to be reduced from 25 per cent. to 15 per cent. ad valorem. Machinery imported in ships' hulls will in the future have to pay a duty of 25 per cent., 'because we found that under the old arrangement there was really an inducement to people to go to the United States and 'build a vessel and put in her machinery there, for they could be both brought in at 10 per cent., while machinery brought in separately was subject to a duty of 25 per cent.' The 10 per cent. duty on tea purchased in the United States is to be maintained. These changes involve a reduction under the head of customs amounting to \$1,000,000. The Government have decided, in addition, to ask Parliament for \$150,000, to be distributed among fishermen in the shape of a bounty, with the design of encouraging the construction of vessels which are now obtained in the United States.

Combating the assertion made by the present government that its policy was in the interest of the United States rather than Great Britain, the Minister of Finance cites the statistics of imports already given in these columns, and remarks: "Now, sir, that shows most clearly, in accordance with the evidence submitted last session of 'Parliament, that there has been a very large increase in the imports from Great Britain over those from the United States. That can be well understood, and it was stated here in 1879 that that would be the case, because the manufactures which it was intended to establish, encourage and maintain in Canada by means of the tariff were those the products of which we had largely imported from the United States. It was not with any ill feeling toward our neighbors that this tariff was established, but we were gratified when we

"found that the policy we had introduced 'would strike against the industries and interests of the United States rather than against those of Great Britain. Such has been the result, &c.'" In like manner the trade and navigation returns are quoted to prove that a falling off of nearly 32 per cent. last season in the trade of the St. Lawrence, was solely due to the exceptional circumstance of railway competition controlled by "a ring" in Chicago.

Our Foreign Trade in Metals, Iron and Coal in 1881.

The extracts below, from tables furnished by the Bureau of Statistics, show that domestic export in the articles mentioned increased notably during the last calendar year.

Articles.	1881. Quantities.	1880. Quantities.	1881. Thousands of Dollars.	1880. Thousands of Dollars.
Bells and bronze	.....	.....	\$10	\$20
Brass goods.....	.....	.....	321	226
Clocks.....	.....	.....	1,114	1,369
Coal, Anthracite, tons.....	541,866	410,880	2,590	1,778
Coal, Bituminous, tons.....	328,295	190,319	814	736
Copper ore, cwt.....	1,790	18,647	54	67
Ingot copper, lbs.....	7,034,775	306,252	1,130	61
Copper ingots, lbs.....	.....	.....	60	60
Gas fixtures and lamps.....	.....	.....	317	311
Pig iron, lbs.....	13,764,284	4,191,738	184	70
Bar iron, lbs.....	866,884	766,008	32	31
Boiler plate, lbs.....	1,838,383	236,014	6	12
Iron rails, lbs.....	1,194,720	2,011,047	34	41
Sheets & hoops, lbs.....	229,448	275,581	9	16
Castings.....	.....	.....	288	212
Car wheels.....	13,643	8,673	139	97
Stoves.....	.....	.....	142	121
Locomotives.....	104	73	914	632
Steam engines.....	94	98	88	130
Steam boilers.....	.....	.....	161	85
Machinery.....	.....	.....	4,518	3,685
Nails and spikes, lbs.....	9,183,373	7,860,322	312	316
Other iron goods, lbs.....	.....	.....	5,766	4,654
Steel ingots and wire.....	437,591	266,745	46	36
Cutlery.....	.....	.....	97	74
Edge tools.....	.....	.....	1,115	968
Files and saws.....	.....	.....	42	32
Fire arms.....	.....	.....	1,018	1,370
Steel rails, lbs.....	1,194,720	2,011,047	34	41
Other steel goods.....	.....	.....	503	351
Lead.....	.....	.....	160	45
Cartridges.....	.....	.....	360	599
Shot and shell, lbs.....	.....	.....	150	1
Argentiferous ore.....	.....	.....	30	68
Patent ware.....	.....	.....	179	241
Plated ware.....	.....	.....	354	287
Type and press cases.....	.....	.....	193	266
Quicksilver, lbs.....	2,680,129	2,872,376	1,028	1,144
Sewing machines.....	.....	.....	215	293
Fire engines.....	.....	.....	2,182	1,826
Tin ware.....	.....	.....	10	7
Watches.....	.....	.....	187	187
Zinc ore, cwt.....	16,000	5,510	16	10
Sheet zinc, lbs.....	1,324,853	1,737,776	117	153
Total.....	.....	.....	\$27,726	\$22,888

In 1880 we shipped only \$22,888,000 worth of metal exports, whereas last year \$27,726,000 left the country. Of iron goods alone we shipped last year \$12,893,000, against \$10,124,000 in 1880. Quicksilver shows but a small decline. Sewing machines, since they are cheaper, sell in increasing amounts abroad. The increase in locomotives will be noticed. Taken as a whole, the result of the year is satisfactory and encouraging.

From the same official source we take the following items of import for the last calendar year, as compared with 1880. The re-export of little importance we have omitted:

Articles.	1881. Quantities.	1880. Quantities.	1881. Thousands of Dollars.	1880. Thousands of Dollars.
Tin, cwt.....	193,564	206,021	\$1,380	\$6,120
Brass goods.....	.....	.....	540	410
Coal, tons.....	84,174	176,046	2,301	1,720
Copper ore, cwt.....	64,607	61,771	131	113
Ingot copper, lbs.....	780,670	4,601,304	68	708
Copper ingots, lbs.....	.....	.....	54	417
Pig iron, lbs.....	1,041,325,045	1,456,268,298	8,211	14,998
Castings.....	.....	.....	220,288	38
Bar iron, lbs.....	94,630,007	251,072,865	2,071	6,722
Boiler plate, lbs.....	37,500	388,379	1	13
Hoops, &c, lbs.....	1,053,074	26,043,598	26	1,033
Iron rails, lbs.....	27,025,172	26,977,834	3,465	4,094
Sheet iron, cwt.....	18,241,898	22,818,867	614	541
Old scrap iron, tons.....	134,917	619,589	2,705	14,705
Hardware.....	.....	.....	84	118
Anch. & chains, lbs.....	3,099,139	2,785,803	124	141
Fire arms.....	.....	.....	1,710	1,661
Firearms.....	.....	.....	1,710	1,661
Steel in ingots, &c.....	.....	.....	1,534	1,883
Steel rails, lbs.....	438,616,349	316,459,138	9,950	5,480
Cutlery.....	.....	.....	1,044	3,008
Files and saws.....	.....	.....	160	156
Other iron and steel goods.....	.....	.....	24	6
Pig lead, lbs.....	2,860,126	6,438,024	5,771	6,772
Lead ingots, lbs.....	.....	.....	274	140
Metal ingots, lbs.....	.....	.....	18	18
White lead, lbs.....	1,274,602	1,896,265	1,508	1,632
Red lead and litharge.....	268,343	190,729	13	10
Tin plates, cwt.....	3,066,106	3,166,076	14,881	15,670
Tinware.....	.....	.....	73	69
Spelter.....	5,411,793	6,166,653	210	204
Sheet zinc, lbs.....	2,656,790	4,388,638	119	221
Total.....	.....	.....	\$21,575	\$22,144

While the general import decreased from \$22,144,000 in 1880 to \$21,575,000 in 1881, or 22 per cent., that of iron and steel alone fell from \$63,667,000 to \$46,667,000, or 27 per cent. So far as the weight given indicates, iron declined from 7,881,336 tons to 6,518,990 tons, while steel rails rose from 141,280 to 222,596 tons. While tin plates show some increase, all metals except pig lead show a decrease.

The abstract of the charge of Judge Baxter, of Ohio, in the case of Hays vs. the Pennsylvania Railroad Company, elsewhere given, will be read with interest. Though not laying down anything which will be recognized as involving a new principle, it is important as defining more clearly and specifically the obligations of a railroad company to deal fairly and equably with shippers. Judging from the present temper of the courts in dealing with railroad questions, we think that more harm than good is to be ex-

pected from legislation designed to make the railroads subservient to the public interest. The danger is that they will intrench themselves behind legislative enactments, and so remain beyond the reach of common law, which now seems adequate to protect the interests of the public when intelligently applied.

Developing Mexico.

To many minds Mexico, as a field for either mechanical or mercantile enterprise, presents a strange fascination. American adventurers of all sorts have gone there within a few months, most of them with little or no capital, and not a few are already bemoaning their mistake. The collapse of the Palmer-Sullivan railroad combination, as it was called, brought to grief a number of once hopeful engineers, surveyors, &c., who are now seeking other occupations. And yet the accounts brought home by those who have explored the ground have in them much of the *couteur de rose*. The editor of a St. Louis industrial newspaper, who has just returned from Mexico after a search for information, expresses surprise at the thrift and advancement in industries apparent at the Mexican capital. A better line of machinery and heavy hardware is rarely found than is seen in two or three warehouses there. No less than six houses are handling American sewing machines on a considerable scale, and among travelers met on the roads it is common to find capitalists, or their representatives, who are engaged in establishing themselves in various lines of industrial pursuits. A concern called the Durango Tin Mining Co. are bringing out machinery and everything necessary to set up reduction works on the American plan. Two oil companies were arranging for an enormous business. In regard to mining operations, we are told that, though there may not be "millions in it," fortunes await those who go in with modern machinery and improved methods. "If you prefer iron to silver and gold, there is plenty of money to be made from its manufacture. The iron ores are exceedingly rich, and can readily be turned to profit. There are next to no furnaces and forges in the entire country, and the man who has the capital to carry on this business, is bound to find a market at remunerative prices for all the iron that he can manufacture. All kinds of machinery are from 100 to 150 per cent. higher than in this country. Raw castings are worth eight cents per pound; bar iron, twelve cents, and nails, fifteen cents. With plenty of everything needed in the manufacture, you can judge for yourself whether there is any money in the iron business or not."

It is good advice, however, that unless a man has money to take in machinery and develop the resources of the country, he had better stay at home. Skilled labor is not in demand until skilled methods of development are in vogue.

Sandberg's Steel Rail Bloom Specifications.

LONDON, 12th FEBRUARY, 1882.
Offices: 10 St. George St., Westminster, S. W. 1.
To the Editor of *The Iron Age*.—DEAR SIR: In your issue of the 2d February (page 17th) there is an article by "Mr. Morrell on the Steel Bloom Discussion," my specification and inspection of blooms being used as an argument against the Treasury Department for imposing inequitable duties on rail blooms. With this view and because it might prove interesting to the importers of blooms generally to know the specification *in extenso*, I inclose a copy. I have worked according to it for very large quantities, and found it giving satisfaction both to producers and consumers. Yours truly, C. P. SANDBERG.

SANDBERG'S SPECIFICATION FOR STEEL BLOOMS FOR RAILS AS WORKED IN 1881.

Time of Delivery......
Dimensions......
Weight......
Marking.—Each bloom to be marked with the maker's name either rolled on the sides or stamped in plain letters at the end, and also to have inspector's stamp after approval.
Mode of Manufacture.—The steel must be cast into ingots large enough to work down into at least two blooms of dimensions required. The ingots must be heated, hammered or rolled as specified to clean blooms, ends cut square and perfectly solid, and the surface to be free from cracks or flaws.
Inspection Mechanically.—Previous to the charge being used, a small sample ingot to be tested from every blow by forging and bending cold to right angles.
The blooms will be passed in lots not exceeding 250 tons each. The inspector appointed by the buyer will select from each lot a certain number of blooms, not exceeding 1 per cent., to be rolled into rails of any sections at hand at the moment. Such rails must be free from cracks, flaws and other imperfections, and the crop ends sustain Sandberg's normal drop test without fracture.
Inspection Chemically.—The steel must be analyzed for carbon by makers to show that it contains the stipulated amounts of from 0.20 to 0.40 per cent., and the inspector has the right to see that this is carried out and also to take borings to check these analyses. Besides the carbon testing the inspector may take borings from any blooms or rails he chooses for general analysis, which must agree with buyer's stipulations for the contents of sulphur, phosphorus, silicon and manganese, but if there be no such stipulation, the inspector will have to satisfy himself that the steel is of proper chemical composition; and suitable for making steel rails of first quality. Part of such borings may be handed over to the works chemist to compare results with the inspector if desired.
The inspector or his assistants are to

have the right of entrance into the works at all times, to inspect the manufacture and quality of material, and to superintend the inspection as well as to inspect the blooms.

Inspection Certificates.—The inspector shall issue certificates of blooms both mechanically and chemically when requested for any portion of the order passed, to state that the blooms are practically within the limits of the specification, and in his opinion suitable for making steel rails of first quality.

Note.—Exporters of blooms and rails may be at liberty to adopt the Sandberg's specification, but unless he himself is entrusted with the inspection, both mechanically and chemically, he cannot be responsible for the results. An inspection book showing that this specification has been executed, both mechanically and chemically, shall be handed to the buyer, who shall then pay the inspection fee, which, on no account, is to be paid by the maker.

19 GREAT GEORGE STREET, WESTMINSTER, LONDON, November 1881.

AMERICAN INSTITUTE OF MINING ENGINEERS.

WASHINGTON MEETING.

The opening session of the Annual Meeting for 1882, of the American Institute of Mining Engineers, was held on February 21, in the New National Museum connected with lecture room of the Smithsonian Institution. Among those present at this and subsequent sessions were: B. Silliman, Orleans Longacre, E. M. Ferguson, A. Hague, J. F. Holloway, A. Heckscher, R. L. Martin, J. C. F. Randolph, E. V. McCandless, H. E. Wrigley, G. W. Bramwell, L. E. Warner, C. A. Ashburner, H. C. Freeman, C. O. Parsons, W. S. Franklin, Clark Fisher, G. T. Wicks, A. P. Boller, Alexander Strausz, John Bogart, O. Chanute, C. H. Roney, G. W. Bramwell, S. H. Chauvenet, E. M. Parrott, Joseph Hartshorn, H. Veeder, William Metcalf, T. M. Drown, M. C. Bullock, A. Hamilton, J. P. Witherow, G. C. Marshall, William Lilly, J. H. Harden, C. A. Statefeldt, Charles Macdonald, O. W. Barnes, H. Burden, N. S. Steith, W. B. Devereux, W. P. Shinn, W. J. Taylor, William F. Biddle, I. G. Johnson, J. M. Knap, F. J. Slade, George H. Frost, J. M. K. Wickersham, F. P. Miles, Paul A. Oliver, G. W. Maynard, A. Winslow, L. A. Riley, T. Eggleston, W. H. Scranton, P. Roberts, Jr., D. Torrey, E. F. Loiseau, E. J. Hurlbut, E. H. Sears, R. W. Raymond, A. D. Churchill, W. Van Voorhis, Knight Neftel, C. H. Morgan, J. M. Hartman, W. S. Ayres, R. H. Sanders, B. F. Fackenthal, Jr., P. G. Salom, M. Coryell, C. O. Thompson, James W. Abbott, W. U. Barnes, H. M. Howe, E. C. Appleton, T. C. Clarke, H. S. Drinker, T. Guilford Smith, W. Hamilton Merritt, S. W. Baldwin, G. H. Hewitt, S. B. Whiting, E. D. Leavitt, Jr., A. Heckscher, J. C. Snook, W. S. DeCamp, G. S. Morrison, William F. Ward, C. Constable, S. W. Rand, S. F. Fisher, T. Sterry Hunt, J. F. Lewis, Albert Spies, M. D. Valentine, David Williams, S. T. Wellman, J. C. Bayles, James Morgan, Jr., B. W. Frazier, J. D. Weeks, H. E. Collins, C. Kirchoff, Jr., Jed Hotchkiss, W. G. Leavitt, J. W. Lewis, J. C. Bayles and others.

The president of the Institute presided, and the evening was given up to introductory exercises. Gen. W. T. Sherman, one of the Regents of the Smithsonian, welcomed the Institute on their behalf.

ADDRESS OF GEN. W. T. SHERMAN.

GENTLEMEN: I have been invited to meet you this evening to extend to you the cordial greeting of the Regents of the Smithsonian Institution, and to assure you that they are most happy to have in their power to place at your disposal this beautiful hall dedicated to science and art. This National Museum is the property of the United States, of which the Regents of the Smithsonian Institution are simply the custodians, and the board has delegated to its secretary, Professor Baird, the right to extend its use to the National Academy of Sciences, and like kindred societies, among which we are glad to class the Institute of Mining Engineers. It is eminently fit that you should meet here at this, the nation's capital, under a roof partly your own, devoted to natural science, and in the shadow of the Smithsonian Institution, founded for the exclusive purpose of collecting and diffusing knowledge among men. Of all the workers employed on earth no single class seems to me more worthy the respect of their fellows than those who seek beneath the surface for the useful minerals and metals which contribute so largely to the wealth and comfort of mankind. In no branch of human industry does intelligence come so immediately in contact with labor. To the mining engineer chemistry, mineralogy and geology are as reading, writing and arithmetic to the merchant, and algebra, trigonometry and geography to the navigator. There is no business or profession where ignorance is so fatal or mistakes more disastrous. No single interest has done more to build up our present empire, and, in my opinion, on no other single interest, except agriculture, does the future grandeur and stability of our country more depend, than on its mines and mineral wealth. I do not mean to tire you with figures or statistics, with which you are doubtless more familiar than I am, but I cannot refrain from giving a very few out of the great mass which have been selected by those engaged in compiling the late census table of 1880.

IRON ORE.	
Product for year ending June 1, 1880.	1,477,735
Value of product at mines.	\$1,372,470
Total capital, real and personal.	\$1,472,573
Number of men employed above ground.	2,812
Number of men employed below ground.	521
Number of boys employed above ground.	2,291
Number of boys employed below ground.	8
Total employees.	4,441

COPPER.	
Product for year ending June 1, 1880.	50,665,140
Value of product.	\$8,842,961
Total capital, real and personal.	\$1,675,095
Men above ground.	4,755
Men below ground.	3,289
Boys above ground.	302
Boys below ground.	90
Total employees.	8,416

West of 100th Meridian.
Product for the year ending June 1, 1880.
Value of product at mines.
Total capital, real and personal.
Number of men employed above ground.
Number of men employed below ground.
Number of boys employed above ground.
Number of boys employed below ground.

Product for year ending June 1, 1880.
Value of product.
Total capital, real and personal.
Men employed above ground.
Men employed below ground.
Boys, under 16, above ground.
Boys, under 16, below ground.
Total employees.

Product for year ending June 1, 1880.
Value of product.
Total capital, real and personal.
Men above ground.
Men below ground.
Boys above ground.
Boys below ground.
Total employees.

Of copper, the Lake Superior region furnishes 90 per cent. of all, and yields pure copper enough to cover 25½ acres with a sheet 1 inch thick. The amount of gold produced in the census year 1880 was \$33,370,663. The amount of silver is reported as \$41,170,957, aggregating precious metals used as coin the world over \$74,400,620. These figures are official—they do not exaggerate, but fall short of the whole truth. They exhibit the net product of some of our mines; and when we follow the metals in their development for the uses of civilized man—when we remember that it takes two tons of iron ore, and from 2 to 2½ tons of coal to make a ton of pig iron worth from \$20 to \$26; that by further manipulation this same ton becomes worth \$40 to \$60 for railroad uses; from \$60 to \$100 for mechanical uses; from \$2000 to \$4000 a ton in the shape of needles, and for watch springs it becomes \$1,000,000, it opens up the question of manufactures not pertinent to this occasion; but you, the mining engineers, give the initiative to this most important subject—you go into the earth and reach the fountain source of this stream of vital industry. I myself was in the new Almaden quicksilver mines of California as early as 1847, and saw the Indian miners, with pick and crowbar, collect the beautiful mineral, load it into raw hide sacks and pack it on their backs, climbing like rats up notched poles to the mouth of the mine, whence it was hauled in ox-wagons to the furnaces in the valley below. I saw the first specimen of gold found in Sutter's famous mill-race, and witnessed all the changes, from the common tin pan to the cradle, the long-tom, the hydraulics, the arastra, and the 100-stamp mill, roaring like the anvils of the gods, with fumes thirty miles long to bring the water needed to separate the metal from its matrix. I have been down in the copper mines of Lake Superior, where their oscillating engines, and inclined railways leading to the deepest pits, where the highest science and ingenuity of man have reduced the necessary labor to the minimum, and produce that beautiful and most useful metal at little over 16 cents per pound. I have also seen Mr. Hill's reverberatory furnace, at Black Hawk, Col., with its roaring flames under the hot blast, melting down rock to a fluid, which is skimmed successively of the useless slag till the precious metals remain below, and are drawn off into the comparatively small "mat." This, again, is reduced to a fine black powder, as unlike silver as a pot of lamp-black; yet chemical affinities draw out the pure crystals of beautiful silver, and a further process eliminates the gold, and leaves still a valuable residue of lead, copper and iron. I have been down in the deep mines of Nevada, where the terrestrial heat suggests a hotter place; where steam elevators bring up the mineral and steam pumps deliver an abundance of hot water to supply the rotaries; and I have seen coal and iron mines of every conceivable kind, and in all quarters of our country, so that I have had some experience, and can bear willing testimony to the industry, the skill and ingenuity of our mining engineers everywhere.

The sinking of shafts, the running of galleries, the disposal of waste material, the guarding against water and rock slides, the prevention of fatal gases, all combine to make your life a continual warfare with nature, and call for a courage equal to that of the soldier in battle; but as the soldier will follow his leader to the death when convinced of his skill, so will the miner penetrate the earth to its inmost recesses if convinced of the skill of his engineer. This is a great and sacred trust for which you should be fully prepared by previous study, reflection and experience. I am confident that you will prove equal to every change and emergency which may arise, and your meeting here is most auspicious, if by comparing your personal experience you can make the occupation of the miner more safe and more profitable than it has heretofore been. There is in the business world as much friction as in mechanics. A constant, vital, mental force is ever necessary to overcome old habits and methods to which the miner clings with as much tenacity as any other class; but we know that change is written in broad characters across the face of nature. True, to-day is as yesterday, and the coming spring will bring forth its flowers as the past, but there was no steam engine at the beginning of this century; the photograph and telegraph were unknown fifty years ago; within twenty years the telephone and electric light have been added to the stock of improvements, and these things are now as essential to human life as food and clothing. We know not what new inventions are yet to be, but we do know that the man who holds back too long, and clings to the familiar knowledge of the past, refusing new knowledge, will be left behind in the great race of life. He will be as the passenger of the old stage coach left in a mud hole, while his neighbor will whirl along at the rate of thirty miles an hour in the modern steam-car. So the mining engineer must keep pace with the mechanical arts; must utilize every new and approved contrivance to diminish human labor and increase net profits, else he will be left behind and see his neighbor prosper. In Egypt you can find to-day the same old mills and pumps, worked by camels

and asses, as were there in the days of Moses; and in Mexico you will find women on their knees grinding corn with the marte, and the old arastra going round and round with its mule, while in the most inaccessible corners of California, Nevada and Arizona the cough of the steam engine is heard and the thunder of the stamp-mill shakes the earth. It is not for us to say which system produces the largest measure of human happiness. It suffices for us to know that we prefer the latter, and mean to reduce mining to an absolute science, yielding the largest profits, and increasing the comfort and safety of the miner to equal those of the former. The Smithsonian Institution accepts the past, and only deals with "new" knowledge—the "increment," so that when you are down in the fissures of the earth and discover any new metal, mineral or principle of natural law, we expect you to add your mite to that colossal column of human knowledge which towers high above the Pyramids of Egypt, and in return we will be most happy to reciprocate by supplying that which we gather from the uttermost parts of the earth. The republic of science has no earthly limits. It embraces the heavens above, the world below, and the waters under the earth. So, my friends, we are a common brotherhood, and we trust that wisdom will govern your counsels and that honor and success will crown your labors.

Major Powell, director of the United States Geological Survey, chairman of the Local Committee of Arrangements, then delivered the address of welcome of the local members. It was in the same line as that of General Sherman.

After the meeting at the institution, Major and Mrs. Powell held a reception for the resident and visiting members of the Institute and the ladies accompanying them, at their residence, M street, northwest. The spacious parlors were thrown open, and for three hours there was an almost continuous stream of callers. Among those present other than the members of the Institute were Vice-President Davis, Senator Hoar, Professor Baird, General Sherman and others of prominence in the National Government.

Wednesday's Session.

The second session of the Institute took place on Wednesday morning, the meeting being called to order shortly after 10.30. After a few preliminary remarks by President Metcalf, Mr. E. F. Loiseau, of Philadelphia, read a paper on

A PROCESS FOR MAKING ARTIFICIAL FUEL from anthracite and bituminous coal-dust, and the applicability of the process to the utilization and solidification of the slacking lignites of the West. After having briefly reviewed the past history of the process, Mr. Loiseau announced that now, after fourteen years of untiring efforts, he was pleased to see that the latter were not entirely wasted, works at Port Richmond, Pa., now being successfully engaged in turning out a product equal, if not superior in many respects, to ordinary coal. He stated that the fuel now made by the Loiseau Fuel Company, at Port Richmond, finds a ready market, the demand increasing steadily, consumers appreciating it for domestic use as well as for manufacturing purposes, thus leaving no doubt as to its merits. When Mr. Loiseau first introduced the process it was proposed to manufacture artificial fuel from a mixture of clay and anthracite coal-dust, this mixture being formed into lumps of convenient size, which, after having been thoroughly dried, were passed through a water-proofing solution. The machinery was found to work in a highly satisfactory manner, but the drying-ovens through which the blocks of fuel were to be passed on wire-cloth belts, proved to be a failure, since the fuel, after having gone through some four or five times, was found to still be in a moist condition. This, however, was not entirely unexpected, and Mr. Loiseau consequently abandoned the use of clay as a binding material, using coal tar in its place. Changes were subsequently proposed in the method of drying the product, the inventor demonstrating that the introduction of these changes would not only materially increase the efficiency of the machinery, but also improve the quality of the fuel. Difficulties and mutual disagreement, however, were the final results of the undertaking, and the company was dissolved. Mr. Loiseau then applied for a lease of the old works on reasonable terms, and a new company was organized, consisting of a number of gentlemen who, notwithstanding the untimely end of the first company, were prepared to lend further aid in the development of the method. The proposed alterations were then made, and in a short time everything was in readiness to demonstrate the complete success of the improvements. The blocks of fuel, which may be of different sizes and weights, are egg-shaped, allowing free circulation of the air, thus insuring thorough combustion. Mr. Loiseau now proposes to introduce small machines to manufacture from 25 to 60 tons per day, for the accommodation of coal operators.

Different kinds of coal dust may be mixed and pressed into blocks, producing a fuel meeting the requirements of all industries. Pulverized ores mixed with coal dust and a suitable quantity of flux may be pressed into blocks, and by igniting these it is stated that the metal contained in the ores is obtained at a less cost than by any of the ordinary methods. The successful application of the process in solidifying the dust produced by the slacking of brown coal of the West (lignite) when these coals have been exposed to the action of the air for some time, will and must be of great importance to that part of our country. Mr. Loiseau further said that it was a matter of no little difficulty to draw a boundary line between lignite and coal. In general, coal of more recent date than that of the chalk formation is termed brown coal, while that formed at an earlier period is called pit coal. According to various degrees of decay we distinguish:

1. Fibrous brown coal—fossil or bituminous wood.
2. Common brown coal—compact brittle masses exhibiting conchoidal fracture.
3. Earthy brown coal, being a mixture of brown coal and earthy matter.

Brown coal is often found associated with iron pyrites, its combustibility being less

than that of wood. No true carboniferous coal has yet been found in California, Oregon, or in any Territory west of Kansas, extensive beds of brown coal, however, being found in many places, especially along the lines of the Northern Pacific, Union Pacific and Kansas Pacific railroads, as well as in the southern part of Wyoming and in the northern part of Colorado. This coal tends to crumble and fall to pieces after short exposure to the air, and is, consequently, a source of considerable loss at the mines. The presence of iron pyrites, previously mentioned, is exceedingly objectionable, causing constant danger of spontaneous combustion. Much of the lignite of the Pacific coast is more compact, approaches more nearly to true coal, and furnishes better fuel than that of the Upper Missouri. Mr. Loiseau, moreover, stated that his process could be advantageously applied to this kind of coal dust by previously drying it at a temperature of 200°, in order to remove the objectionable water held in combination. At present negotiations were said to be pending, and it will probably not be long before compressed lignite will appear in the Western markets, and will be appreciated as much as compressed anthracite coal dust is appreciated in our Eastern cities—Philadelphia, for example. At the conclusion of this paper, Mr. J. D. Weeks, of Pittsburgh, stated that he could fully indorse all that had been said concerning the fuel, and delivered some complimentary remarks regarding Mr. Loiseau's process.

THE SECOND PAPER OF THIS SESSION WAS ON: COAL IN THE SANTA ROSA DISTRICT OF NORTHERN MEXICO.

by Mr. William H. Adams. After referring briefly to the coal fields of the Rio Grande, extending over hundreds of miles, and to the lack of surveys or examinations, Mr. Adams stated that in this region nature has disclosed near the surface seemingly inexhaustible beds of semi-anthracite and bituminous coals. Several openings which have been made about 100 miles northwest of the Rio Grande confirm the excellence of the coal found in this locality, which at one time must have experienced great volcanic disturbances, the seat of the volcanic action being marked and easily traceable. Silver is also found in small quantities. Anthracite veins have been opened to a depth of some 240 feet, and surface openings at several points give evidence of large deposits of the valued treasures. Some of the coal found in this region is estimated to yield about 60 per cent. in weight of good coke, and 50 ovens will be erected in the coming spring. Bituminous coal is found from 30 to 50 miles east of the Rio Grande, and lignites are distributed through a large portion of the country drained by that river. The future commercial value of these coal deposits must be determined by metallurgists and railways. After a brief discussion of this paper, Mr. J. C. F. Randolph, of New York, gave some information concerning

A NEW MILL AT BATOPILAS, MEXICO, this being a 15-stamp mill, of 750 pounds per stamp, and designed to run at a speed of from 80 to 85 "drops" per minute, the drop being about 8 inches high. The stamp stones are 10 feet long and are provided with Coleman tappets, while the mortars are furnished with cast-iron bed-plates. Each mortar is provided with a self-feeding arrangement, and the reduced mass of pulp is led off in the usual way, passing directly to the pulp-boxes, which are situated under a turn-table for the pulp cars. The settling pans have cast-iron bottoms, the sides being of boiler plate. The cost of the ironwork is estimated to be about \$16,000, and the entire cost of the mill is \$40,000.

The reading of this paper was followed by a paper on the comparative efficiency of fans and positive blowers, by Henry M. Howe, eliciting considerable discussion, in which a number of members participated. The next paper, by C. Henry Roney, of Philadelphia, gave some information concerning the Thompson pulverizer, a full description of which, together with an engraving, was published in our columns but a short time since, thus obviating the necessity of further dwelling upon it at the present time.

The afternoon session at 3 o'clock was entirely devoted to eulogies of the late Alexander Holley. Several excellent addresses were delivered, and numerous dispatches from England and the Continent were read, showing the great sympathy felt by all who knew Mr. Holley. This session was of such general interest that we shall report it separately as soon as our stenographic notes can be transcribed.

The whole of the evening session was devoted to the discussion of a subject of more than ordinary interest and importance, namely:

TESTS OF IRON AND STEEL AS STRUCTURAL MATERIALS.

It will be remembered that a commission, consisting of several distinguished army and navy officers, as well as civil engineers, was appointed by Congress several years ago, the object being to make thorough investigations into the above subject, and to publish the results arrived at for the benefit of all for whom they had interest. A testing machine was built at Watertown, Mass., and, though everything was ready for the execution of the proposed experiments, the work of the commission was never carried out on account of the untimely exhaustion of the appropriation (\$75,000) made by the Government. Of late, however, considerable attention has been given the subject, and, at the last meeting of the American Society of Civil Engineers, it was resolved to urge the Government to resume the investigations and experiments. Mr. Ashbel Welch, president of the American Society of Civil Engineers, was introduced by President Metcalf, and, after a few remarks of general interest, gave a brief outline of the subject, indicating what should be done to insure greater safety in structures of importance. Mr. Charles Macdonald, who was then called upon, read the following interesting paper on

THE NECESSITY OF GOVERNMENT AID IN ORGANIZING A SYSTEM OF TEST OF MATERIALS USED FOR STRUCTURAL PURPOSES.

It may seem to be almost unnecessary to occupy the time of the Institute in further consideration of a question which has been comprehensively treated in papers already

on file in our own "transactions" and in those of the American Society of Civil Engineers. Unfortunately, however, the results of these concerted efforts have not been to materially increase our stock of knowledge in the direction sought for, and as the necessity for this information is becoming more and more apparent as the demand for structural material increases, it is believed that by continuing the agitation, by means of discussions in this and kindred societies, whose members are vitally interested in obtaining reliable data as to the properties of the materials they are called upon to work with, public opinion may be educated up to the importance of exerting such an influence upon the lawmakers of the country as will result in the formation of a competent board, with adequate means at its disposal to carry out this great work in a manner alike acceptable to the makers and users of the material in question. It may be proper, in the first place, to glance briefly at what has been attempted thus far, then to indicate some of the more important lines of needed investigation, and finally to consider reasons why Government aid may with propriety be sought for in carrying on the work. At a convention of the Society of Civil Engineers, held at Chicago June 5, 1872, on motion of Gen. Wm. Sooy Smith, the following resolution was adopted:

Whereas, American engineers are now mainly dependent on formulae for the calculation of strength of the different forms of iron and steel, not based on experiments upon American materials and manufactures; and

Whereas, These differ greatly in many of their characteristics from those of foreign production, both in their nature and forms; therefore,

Resolved, That a committee of five be appointed to urge upon the United States Government the importance of a thorough and complete series of tests of American iron and steel, and the great value of formulae to be deduced from such experiments.

Pursuant to this resolution a committee was appointed, by whose efforts Congress was induced to pass a law, March 4, 1875, providing for the appointment of a United States Board to test iron and steel, and an appropriation of \$75,000 was made for that purpose. The board appointed under the law above referred to consisted of Col. T. T. S. Laidley, Ordnance Department, U. S. A.; Com. L. A. Beardslee, U. S. N.; Lieut.-Col. Q. A. Gillmore, U. S. A.; Chief Engineer David Smith, U. S. N.; Wm. Sooy Smith, C. E.; A. L. Holley, R. H. Thurston, A. M. C. E., secretary, and they were ordered to report from time to time to the President of the United States.

The first and most important duty of the board was deemed to provide an accurate testing machine. This proved to be a more serious matter than was at first supposed. There were no machines in the country which could be considered as giving anything more than approximate results, and to construct a new machine upon approved principles required much time and a large expenditure of money; much more, in fact, was represented by the sum paid for it. At length a machine was completed, which for accuracy of the results obtained and range of power exerted, is unequalled perhaps in the world. Owing to the length of time expended in completing it, however, the original appropriation became exhausted and the board was legislated out of existence, having had scarcely an opportunity to verify the capabilities of the very instrument which had been brought to perfection under its fostering care, and through the proper use of which so much valuable information could be obtained.

As might have been supposed, the board did not confine its efforts to the construction of this machine. About 150 specimens of steel were analyzed and tests of their physical and mechanical properties made, with a view to determine the relation between chemical constitution and useful qualities. In wrought iron the effects of reheating and re-rolling were carefully examined, and the report contains valuable information as to the different processes of making and rolling iron, the effects of various kinds of strain, the best methods of making cables for large vessels, and to determine how uniform strength can be secured in iron of different sizes in the bar, and how to make large masses equally strong with small pieces. Alloys of copper-zinc and copper-tin-zinc were exhaustively examined and the results exhibited on a small triangular model, from which may be obtained, by inspection, the characteristics of any possible combination of these metals. Extensive preparations had also been made for ascertaining, experimentally, the strength of rolled beams and shape irons, for which we are now dependent almost entirely upon theoretical formulae. Although the board had ceased to exist the machine remained the property of the United States. It is located in the Watertown Arsenal, near Boston, under the immediate charge of the Ordnance Department of the army, and is nominally at the service of engineers and others who may be able to defray the necessarily heavy expenses of working it for their own private benefit.

So much for what has already been accomplished. Should the efforts now being made to revive interest in the subject prove successful, the field for investigation will be found to be most fruitful of results. To mention a few instances only: In the department of bridges there were required for last year's construction not less than 8000 tons of iron and steel, representing say 50 miles of bridges, over which the safety of life and limb is supposed to be assured by the accuracy of the calculations of the designers, no less than the quality of the material employed. Of this material upward of 35 per cent. is in the four compound sections specially adapted to resist compressive strains, and yet, until quite recently, all the experimental data upon which such sections are designed were obtained through the instrumentality of testing machines, which, particularly at high pressure, are liable to give very erroneous results. I quote as follows from Mr. Holley's paper on the U. S. Testing Machine at Watertown, Vol. VII, Transactions of the Institute, page 259, alluding to C. E. Emery's device for overcoming packing friction: "It is certainly worth many times its cost in proving the worthlessness of

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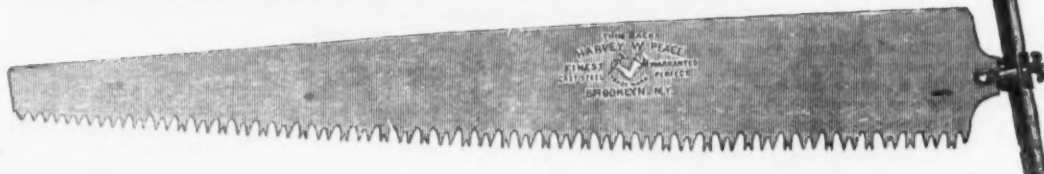
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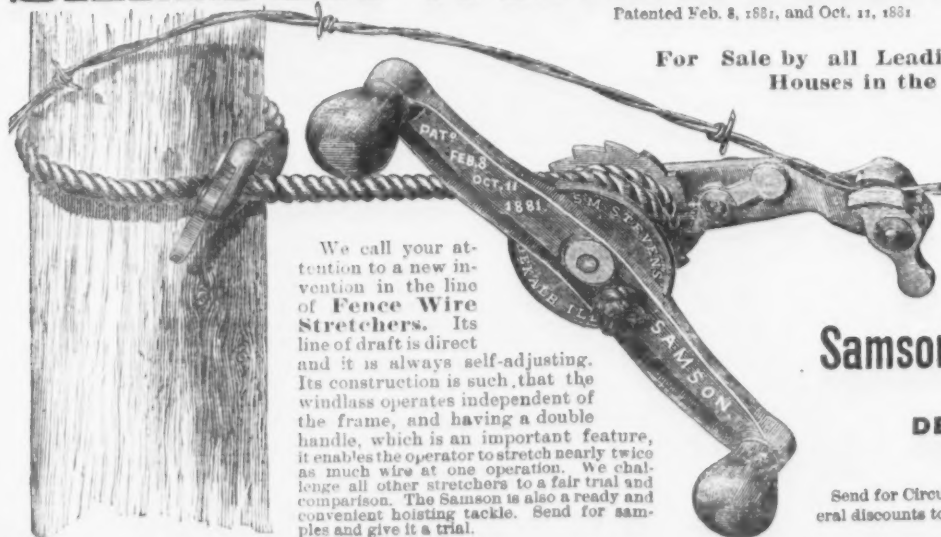
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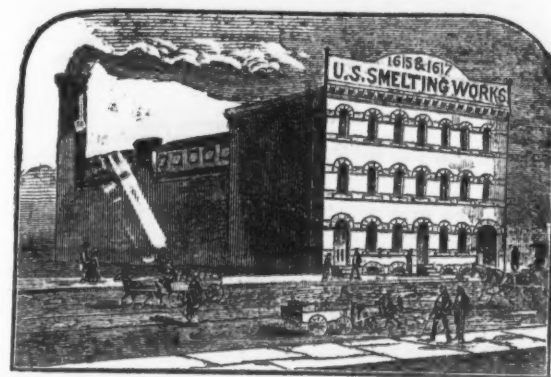
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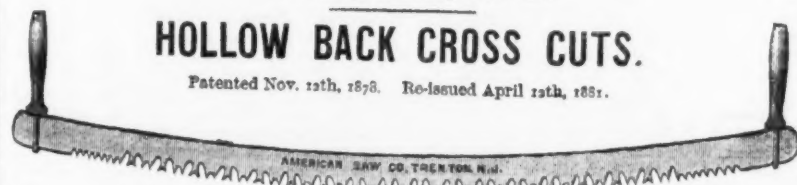
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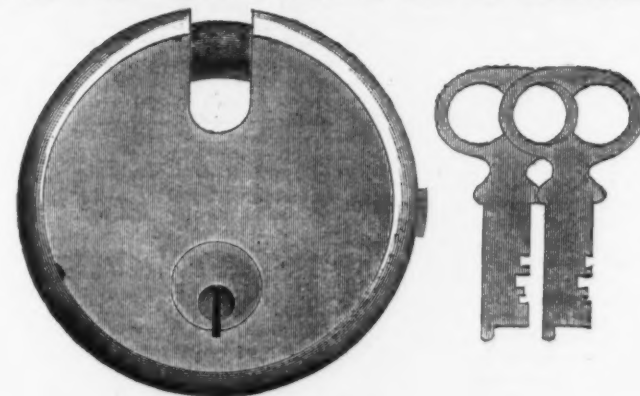


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hydraulic testing machines as heretofore constructed. The readings of the permanent weighing apparatus, as compared with those of the cylinder gauge when the piston was not revolving, showed, in some cases, an error of 40 per cent."

It is safe to say that the recent fall of one of the most important bridges in the country would not have occurred, if at the time of its construction the engineer could have tested full-sized sections of his material on such a machine as the Government now owns at Watertown Arsenal. The tension members of bridges are in the form of eyebars varying in sectional area from 1 to 10 inches. Until quite recently it was assumed that the same strain per square inch might be applied indiscriminately without regard to the size of the members or to the amount of work done upon the material in the rolls, but the few bars which have already been tested at Watertown clearly indicate that this is a most erroneous assumption, and one of the first duties of a testing board would be to establish the law governing the diminution of strength due to increased section, and to establish the relation between ductility and ultimate strength. Then would follow tests to determine proper form of head, and such other details of manufacture as might suggest themselves. Of rolled beams there were produced last year upward of 50,000 tons. This form of product is used chiefly in floors of buildings, often to sustain great weights, as in warehouses and somewhat also as stringers in bridges. Their strength is estimated by theoretical formulae, in which the physical constants are taken from experiments upon foreign irons tested under circumstances entirely different from those obtained in actual practice. Fortunately for the cause of safety in the use of such material, it is probable that the formulae in question do not represent the full strength, and that a considerable amount of unnecessary weight is loaded upon our structures in consequence, but there is all the more reason why the actual strength should be determined by experiment, in order that a uniform factor of safety may apply to every member of a structure, or, in other words, that it shall be equally strong in all its parts. Did time permit, it would be possible to point out many other directions in which experimental knowledge is sadly needed, but if nothing else were done than to determine practically the laws which govern the strength of compression and tension members of bridges, and the flexure of rolled beams, a very great advance would be made in our modes of construction, and a greater safety would be assured to the hundreds of thousands of people who are constantly trusting their lives upon such structures.

What has been said regarding the importance of testing particular constructions applies equally to iron and steel; but there are special reasons for investigating the properties of steel which should command attention. It is admitted to be the metal of the future, for large constructions at least; it is stronger and more homogeneous than the best iron, and owing to the substitution of mechanical appliances for wasteful muscular effort in its manufacture, there will come a time, and that before very long, when it can be furnished commercially at less cost than iron, in large quantities and of uniform quality. It only remains now to determine by a constant and interested authority what the general characteristics of this material are to insure for it a continually increasing demand. At present the finished product of the converter is principally in the form of steel rails. It so happens that the best testing machine for a steel rail is the track, and railroad companies, by careful inspection taken in connection with chemical analysis, are thus experimentally determining the quality of steel which answers best for that particular purpose. For other constructions, such as bridges and ship work, very different qualities of steel are required, depending on the nature and direction of the forces to which it is subjected; and until all such questions are determined by competent and disinterested investigators, the benefits to be derived from the cheap production of steel, by the pneumatic or open-hearth process, will for a long time be confined to the favored few who are engaged in supplying the demand for steel rails. It is hoped that enough has been said to establish the fact that a producing class of the community stands in want to-day of certain scientific information, which, if obtained promptly and in a manner to command universal acceptance, would tend to improve and enlarge one of the staple industries of the country. From the nature of the case, such information can best be obtained by the assistance of the general Government. Shall the effort be made to secure such assistance? It may be asked, "Why should the United States Government appropriate money for the purpose of making experimental investigation which might as well be undertaken by those who are immediately interested?" In reply to this, the following quotation from the memorial recently presented to Congress by the American Society of Civil Engineers will commend itself: "And your memorialists further represent that there is no prospect that the necessary tests will be made without the aid of the Government. Should private manufacturers or builders test their own materials, they might not give the public the benefit of their experiments; such experiments would not have that assurance of impartiality and that high authority which those made under the authority of the Government would have. Experiments conducted by private parties would be so different in the objects, methods and circumstances of applying tests as to render it impossible to properly collate and verify them; they would, therefore, be of comparatively little value in ascertaining accurate general results." I am aware that it is often a difficult matter for legislators to draw the line between public and private interests, and that in the multiplicity of claims made upon them they must be expected to look doubtfully upon anything that calls for money; but it would seem that where such enormous revenues are derived by the country from the effort to secure the exclusive consumption of American manufactures of iron and steel, it would be asking no more than justice for the users of these materials that the Government should lend substan-

tial aid in determining their general characteristics. Again, the Government of the United States is in possession of a most important element in the problem—the testing machines already referred to. It represents a very considerable expenditure in money and years of patient labor, which it is safe to say would never have been expended had there not been a well-grounded hope that an amount of knowledge would be obtained through its instrumentality which would contribute largely to the general good. In its present shape this machine is utterly unable to meet the wants of even such private demands as may be forced to use it.

I am informed by an engineer now engaged in the construction of one of the most important bridges in the country, that he recently sent to Watertown nine steel eye-bars to be tested, and it required 7½ days to make the tests, while the cost to his company was at the rate of \$15 for each bar. This is admitted to be due to the fact that there are no means at the disposal of the department wherewith to engage an efficient permanent staff of assistants to handle the specimens promptly, and the result is that a most valuable instrument for scientific research is allowed to remain in comparative idleness for the want of a few thousand dollars. As to the most effectual means of expending Government aid in the direction sought, there may be differences of opinion, but all are agreed as to the necessity of obtaining results which could be accepted as authority alike by manufacturers, builders and engineers. This could be accomplished either by the appointment of a special committee, similar to the one created under the law of March 4, 1875, with an adequate appropriation to purchase materials and make a comprehensive series of tests; or, failing in this, a moderate sum of money might be placed at the disposal of such an institution as the one under whose auspices we are now assembled, to be expended in testing such construction as would be furnished from time to time by engineers and others in their regular practice, with the understanding that all information thus obtained should become public property by regular publication in the "transactions" of this and kindred societies. Could we feel assured of the permanence of a special commission, the members of which could devote the necessary time to the work, this would doubtless be the most satisfactory to a large majority of those interested. There are uncertainties, however, connected with all such special legislation in a Government constituted as ours is, that should be carefully considered in this connection lest we should be compelled to undergo a similar experience to that which befell the previous board, which, from no fault of its own, was brought to an untimely end after having perfected the means by which for the first time really accurate testing could be done in this country. It is to be hoped that eventually a Department of Public Works will be instituted, having co-ordinate power with other departments, as of the Interior for example, to which all questions relating to the expenditure of public money, either for internal improvements or for scientific investigations connected therewith, may be referred, and through which the interests of the producing classes, including engineers, builders and manufacturers, might receive that special consideration which their importance demands. Whatever method may be adopted will be liable to defects as a matter of course. We must be content to go slowly and surely, to be patient and judicious in advocating our claims, and, above all, to bear in mind that if our cause is a good one, as we believe it is, and we do not succeed in impressing its importance upon Congress, it will, in all probability, be our own fault.

General Meigs stated that his views coincided in all respects with those of Mr. MacDonald, and that since the Government was perhaps the largest single consumer of iron and steel, it would seem quite natural and proper that it should conduct these tests on a sufficiently large scale to be of value.

Captain Lyle, of the Ordnance Department, spoke of his experience concerning the unreliability of ordinary testing machines, and stated that in some of his experiments he found that long specimens of metal gave results entirely different from those obtained when testing short specimens. In one particular instance, a gun having a strength of 63,000 pounds (as shown by experiments in the testing machine) burst when subjected to a strain not exceeding half this pressure. Subsequent experiments with fragments of the gun, turned down to a suitable size, again showed the strength to be 63,000 pounds. This clearly shows to what extent tests, as ordinarily conducted, may be depended upon. Captain Lyle then made a number of valuable suggestions as to the best methods of promptly publishing the results of work, and as to the removal of the testing machine at Watertown, Mass., to a point more conveniently located. This removal would, of course, entail considerable expense, as well as time and labor, besides necessitating the erection of a suitable building for its location.

A letter was also read from Col. T. T. S. Laidley, to the Chief of Ordnance, in which some interesting statements were made concerning the daily amount of work done by the machine and the necessary expenses to conduct this work.

The president then called upon Mr. E. D. Leavitt, Jr., who had availed himself of the Watertown machine very largely, and who consequently had considerable experience concerning the conducting of tests, and the practical advantages to be derived therefrom. Mr. Leavitt responded as follows:

THE WATERTOWN ARSENAL TESTING MACHINE.

The writer desires to state briefly his views respecting the great practical value of the Watertown testing machine, and the necessity that exists for an able permanent commission to supervise its operation, in order that the results of all tests made thereon may be properly worked out and rendered available for public use. It is doubtless known to the Institute that this machine has for the past two years been placed at the service of the public upon the payment of a per diem charge. It was my privilege to be among the first to use the testing machine, and the results of my experiments were of such importance, owing to the great capacity

and extreme accuracy of the machine, that it has since become my practice to have tests of all materials used in construction that come under my charge made at Watertown. As a consequence, nearly 100 tests have been made for the writer's account alone, and some 240 additional for work built from his designs. It may be confidently affirmed that the factor of anxiety on all these structures is exceedingly small, as far as the quality of material is concerned, while it undoubtedly is a very great advantage for any tests that come within its scope made on the Watertown machine. The engineering profession, and through them the general public, do not reap the advantages that they ought, when it is considered that the machine is public property. It may be asked, Why do not those who have made use of the machine make public the results of the tests that have come under their notice? To which the reply must be that the interests of clients are generally paramount to the interests of science, leaving no time for properly working up the data for publication. It is also natural that special information bought and paid for should be considered personal property. Engineers are almost invariably busy men, and rarely, very rarely, is there found one among us who, like our lamented Holley, has apparently time and capacity for all things. The writer's advantages have been exceptional from the fact that his residence is but a short distance from the Watertown Arsenal, thus affording the opportunity of being personally present during tests, with very little loss of time. Such privileges can be enjoyed by very few of the profession without serious inconvenience. The machine is operated in a first-class manner by those at present in charge, but with the rapidly increasing demand for tests a larger force of experts is absolutely necessary, all of whom should be of such reputation as to command the confidence of the profession and the public. There seem to be certain men who, like Regnault and Tyndall, are born experimenters, and men possessing similar qualifications are needed for the permanent commission, in order that the full advantages of the great testing machine be realized. Our knowledge regarding the strength and behavior of material under strain is yet very limited. The best and most experienced constructors admit and lament this. In these days of high speed by railways and steamship, of long span bridges and deep mines, engineers must know what materials will safely endure; life depends upon it, and every means available for increasing and disseminating information on a subject which is of such vital consequence to all should be provided. The writer freely acknowledges that he has learned more about structural materials through the tests made at Watertown during the last two years than in 25 years' previous experience. At the same time he is aware that he has by no means secured all the advantages to be obtained from the data in his possession, or that might readily be secured by a commission of experts, specially devoted to the duty, with ample time for observation, and provided with the best known appliances on making experiments.

Mr. T. C. Clarke, who was then called upon, said that the era of scientific investigation, upon which we are now entering, called for experimental tests of full-sized members of iron and steel structures. We are not in want of a machine to do this work, which should be done for the benefit of our country, but simply require a board of scientific men, under whose immediate supervision the experiments should be conducted and the results published. Bridge builders, for example, are fully convinced of the fact that steel is the structural material of the future, but at present it is used to a limited extent only, owing to the small store of knowledge which we have of its resistance to strains, so far as bridge members of large size are concerned.

Mr. O. Chanute, vice-president of the American Society of Civil Engineers, said that foremost among the many problems to be solved by the engineering profession were the investigations concerning the behavior of steel under strain, the influence of size upon strength, and many others of equal importance. At present we are dependent upon the results of experiments made abroad, or we must wholly rely on the results given by application of theoretical formulae, which, it should be stated, very rarely make provision for cases such as occur in actual practice.

Mr. A. P. Boller, a prominent engineer, presented the question concerning "The Effort to Organize a New Board for the Testing of Iron and Steel" in an interesting paper, which we reproduce here on account of the general information it contains and the interest attached to it. Mr. Boller spoke as follows:

THE NEED OF A NATIONAL BOARD FOR TESTING THE METALS OF CONSTRUCTION.

In the victories of peace, as well as of war, the science of engineering has played a prominent part, if, indeed, not the leading one. While it might be interesting and food for profitable thought to trace the development of engineering from early times in its bearings upon the social betterment of mankind, it will be sufficient on the present occasion to suggest a few thoughts that it is hoped will aid the unprofessional listener to an appreciative consideration of the subject matter laid down for to-day's discussion, and possibly lead the professional brother to a higher conception of the profession to which he belongs.

Since the advent of the railway era it is difficult to grasp the sequence of historic events that have led to the wondrous development of mechanical science, making possible the civilization that is our daily boast, and opening up a vista of future intellectual and moral advancement among the nations of the earth before which the imagination becomes hopelessly lost. Even now, looking back over a period of only half a century, we often fail to realize the vast change in the relations of individuals and nations to each other, brought about by the results of those mechanical discoveries which have made the whole world kin, thus exercising a resistless leveling influence that bears fruit politically in the spread of republican ideas, and morally in the elevation of the individual through the facilities given to the dissemination of christian ideas and general intelligence. In

this view it seems almost like a work of supererogation for a body of representative men of one department of that science to which the world owes so much, to meet here at the center of our national life, to plead not only for a practical recognition of the national importance of the work to which their lives are devoted, but also for national aid on a scale beyond that of private effort, to the end that mechanical science may be carried to a higher plane than ever yet attained, each step on the way being of material benefit to every man, woman and child in the community. Possibly this is strong language, but none too strong when we consider that the work for which we plead is one affecting not only vast scientific and commercial interests, but also human life, to a degree little appreciated by those whose occupation or calling is outside of those silent workers in the domain of applied science. What so intimately affects the people in every household is worthy of the profoundest sympathy of the legislative powers, and the members of any Congress who grasp this subject as its magnitude and importance demand, will live to see not only a great work performed in the interests of science and manufactures, but also a web of protection thrown around every hearthstone in the land, by removing to a great extent the ignorance and empiricism to which too many broken bridges, fallen buildings or imperfect machines testify.

It is popularly supposed that engineering is an exact science, treading as far as it is developed on positive data. If this were true, there would be no need for a Government commission for testing the metals of construction. While engineering theory has been most thoroughly established, covering almost, if not entirely, all departments of the science, engineering facts are in an unsatisfactory state, and must remain so until experiments on the strength of materials are made on a scale which a national government alone can supply. The unsystematic and now admitted crude experimenting, on which the physical data in use all over the world is based, has brought out during the last decade the fact that our knowledge of the properties of iron and steel is less accurate than it was heretofore supposed, and that the scale on which such experimenting has been done is utterly insufficient to determine the true value and application of the metals in the forms and masses as applied in the arts. To the layman, with all the triumphs of modern engineering before him, this statement may seem contradicted by those engineering successes, but such works are always based upon a "factor of safety," made large enough by prudent engineers to cover up not only the imperfections of workmanship always inseparable from the best of human endeavor, but also those deficiencies of exact knowledge regarding the properties of metals used in construction that past experimenting has disclosed. Every factor of safety, therefore, is composed of two parts—the factor of safety proper, and the factor of ignorance. It is the determining of the exact proportions of this factor that engineering science now demands, that ignorance may be eliminated and dishonesty checked from taking refuge in the protection due to the margin allowed for the "factor of ignorance." This "factor of safety," such as it is, is the sole protection of the millions of people daily carried by the railways of the world, and all other modes of mechanical transportation, to say nothing of the occupants of innumerable public buildings and places of assemblage. Further, as an economical measure, the establishment of a factor of safety based on exact data deserves more than a passing comment—an economy resulting from a direct saving in the use of materials, in the broadest sense, and in the prevention of their abuse. Measured by product, the United States is rapidly coming to the van among the nations of the world in the manufacture of iron and steel, being second only to Great Britain. The past year witnessed some 6,000,000 tons of iron and steel made in this country, the scientific use and economical application of which becomes of the first national importance. It may be a revelation to some that there is no standard of authority as to the strength of the metals of construction, and that engineers are by no means agreed upon the limits of strain that may be imposed on iron and steel under given conditions. Some years ago they thought they knew more; but under more exacting requirements, more extended observation and higher technical training, they have arrived (with rare exceptions) unanimously to the conclusion that no authoritative data exists for designing metallic structures, nor can exist, until some central authority, like a national government, establishes a system of experimenting upon the metals on scientific principles, and on a scale that bears some proportion to the shapes and masses as actually used in construction.

From the preceding remarks it must not be concluded that engineers have all these years been practicing a rule of thumb, and depended upon their intuitive perceptions for the successful practice of their profession. It must be remembered that metallic constructions are of comparatively recent date, and that their development is dependent upon a great volume of experimental data that takes more or less time to accumulate and analyze. Much experimenting has been done, and is now being performed continuously in all parts of the world by private individuals, either for trade purposes or private investigation. A considerable portion of such work gets before the profession in a fragmentary sort of way, finally getting into our text-books as authority, supplementing the English tables that have been handed down through all the engineering text-books that have ever been published. And in this connection it is proper to confess that American practice is largely governed by the tradition of English experiments, which have come before the world in a more accessible shape and greater fullness than could be elsewhere obtained. These English experiments, dating from the construction of the Britannia and Menai bridge tubes, have ever since been published the world over as authority, and the names of Eaton, Hodgkinson and Sir William Fairbairn, by whom these experiments were devised and conducted, will ever live as pioneers in the art of iron construction, and be revered as long as

the profession of engineering has a follower—particularly that of Fairbairn, whose whole long and busy life was devoted to experimental knowledge, and whose researches to this day are largely our guide in practice. The next step forward in a still more accurate knowledge of the constructive value of iron and steel were the experiments of Kircaldy, about 1862, made under the patronage of one of Scotland's great ship-building firms—that of the Messrs. Napier & Sons, by whose permission they were given to the world, and largely added to existing knowledge. These experiments disclosed many important factors in the behavior of metals under stress overlooked by all previous experimenters, and opened up a range of investigation, that has ever since been profitably worked. These experiments, as well as all preceding ones, were conducted on what we may call specimen sizes of the various irons and steels manufactured in Great Britain, and while valuable as far as they go, are utterly insufficient as standards to judge of the absolute value of structures as a whole, or of the parts of which they are composed, to say nothing of the fact that American interest is in American metals and not in British. Chemical composition, as affecting the strength of iron or steel, has only recently claimed attention, growing primarily out of the Bessemer steel industry, and cannot be neglected hereafter. It is a matter of comparatively recent record that iron or steel in small bars has a very different value from the same metal rolled in large sizes, and that the shape in which such bars may be rolled very materially modifies their strength. In general, we have discovered that while experimental specimen sizes, on which our tables are mainly based, give comparative values for different qualities of iron or steel, they are misleading as to absolute values, only determinable by testing the sizes and shapes as used in actual construction. The question of abrasion has still to be investigated, and when one reflects that this is a vital question in the economical use of steel rails, the importance of such an investigation cannot be overrated. In steel particularly there is much to learn—at least, by the profession at large—few engineers having the temerity to use it with the present lack of knowledge of its physical properties; yet it is a metal that the constructive demands of the age are forcing on the attention of engineers, and, as the metal of the future, a full and elaborate series of physical and chemical experiments, upon such shapes and sizes as are needed in actual construction, should be undertaken at the earliest moment. Another branch of investigation is greatly needed, and that is upon the effect of vibration and impact—on which the life of metal structures largely depends. Some few investigations in this branch of experimental research have been made by Fairbairn in England, and in considerable number by the late Baron von Weber in Germany, both pointing in general terms to a period of destruction under repeated impact and vibration, should such successive impacts strain the material beyond a certain point. It would be a long catalogue to enumerate, with any fullness, the unexplored regions awaiting the investigator in the properties of metals, and involve a degree of technical statement out of place on this occasion.

Enough has probably been said to awaken an intelligent interest in the thoughtful lay mind, and it is hoped it will bear fruit in due season. The American Institute of Mining Engineers is only an advance guard in pressing this subject upon the attention of Congress. The two other representative bodies of engineering science—the American Society of Civil Engineers and the American Society of Mechanical Engineers—are thoroughly in earnest in the matter and will soon be heard from, converging, as it were, the voice of all minor societies and mercantile associations, the factories, mills and workshops of the country, in one harmonious demand that Congress shall give ear to the grand scheme presented to them for action—a scheme in the interest of no faction or body of men, but in that of the whole people. This idea of establishing a national board for the testing of American metals is not a new one, and it is proper in this place to refer to past efforts in that direction. In 1875 such a board was constituted by act of Congress, on recommendation of the House Appropriation Committee, of which the lamented Garfield was chairman. The personnel of the board were selected with great judgment and represented satisfactorily the various departments of the industrial and engineering branches of science. The Ordnance Department of the army had previously been at work in this direction for ordnance information, and had already in hand the construction of a testing machine on a new principle, and of such proportions that experiments could be made on a scale and with a degree of accuracy never before attempted. On the creation of the Testing Board, the work of the Ordnance Department was consolidated with it, and everything promised fair for results that would not only be of inestimable value to our own people, but be of great national credit throughout the world. The board lost no time in organizing and laid out an exhaustive scheme of work, covering all possible uses of the metals, under sub-committees for each special department of investigation. They at once took in hand the testing machine previously contracted for by the Ordnance Department, and used every effort for its early completion. This was prolonged far beyond the anticipated time, and swallowed up in its cost almost the whole of the original appropriation of Congress, viz., \$75,000, a sum far in excess of the original estimates, thus materially crippling the work of the board at the very outset. For the information of those unadvised in the matter, some explanation is here necessary. The testing machine selected by the Ordnance Board, and approved by the National Board, is the product of years of labor and expenditure on the part of Mr. Albert H. Emery, C. E., being the first one ever built on the magnitude contemplated, and involving such novel principles, leading to an accuracy hitherto unapproached by any other machine ever built or conceived of, that the American Society for the Advancement of Science, at its Boston meeting, found the Emery machine alone worthy of its great gold medal as the most important contribution to science during the year. This machine is one of the world's



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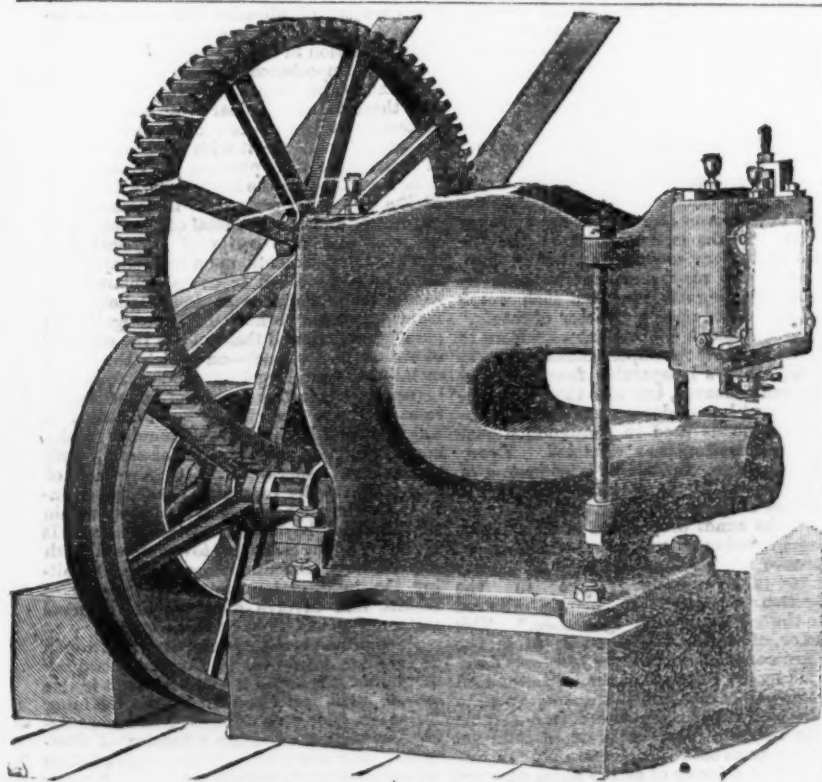
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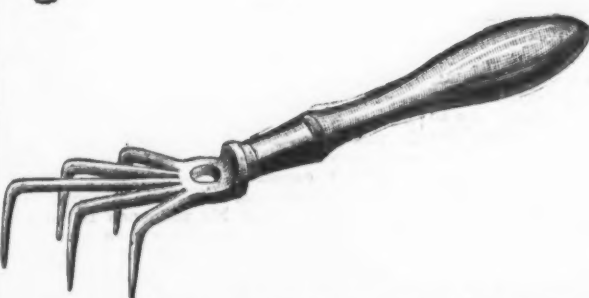


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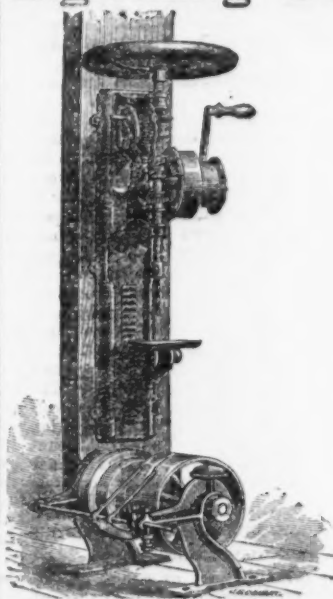
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From the Benedict and Burham Mfg. Company, Waterbury, Conn., Aug. 19, 1879.
Ezra Sawyer, Esq., Worcester:—I have used your Magnetic Metal Separator for several months, and can recommend it as the best thing we have ever seen for separating iron from brass, composition and other material. It is a great labor-saving device, and has more than paid for itself in its use.

From the Union Water Meter Company, Worcester, Mass., Sept. 1, 1879.
J. C. Otis, Treas.

From Peck Brothers & Co., New Haven, Conn., Sept. 4, 1879.
Ezra Sawyer, Esq., Worcester:—We are pleased to inform you that the machine we purchased of you for cleaning our turnings and swages works admirably, and does its work thoroughly. It will very soon earn all it cost us. Respectfully yours, J. M. PECK, Treas.

From Brown & Brothers, Waterbury, Conn., Sept. 4, 1879.
Ezra Sawyer, Esq., Worcester:—Dear Sir: We have used your Magnetic Metal Separator several months; it works to our satisfaction, and we cheerfully give it our recommendation. Yours truly, B. VAN DUSEN, Agt.

From Brown & Brothers, Waterbury, Conn., Sept. 4, 1879.
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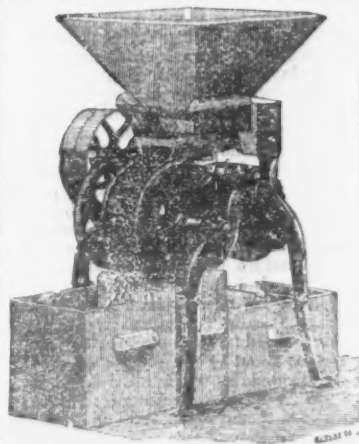
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Manufactured by
EZRA SAWYER, 33 Hermon Street, WORCESTER, MASS.

mechanical wonders, and will exert a pressure so delicate as to weigh to a nicety the strength of a hair or an egg shell, and so powerful as to bring into play a force of 400 tons, and in either case with absolute accuracy. This machine being a novelty in itself like all new contrivances, could not be confined to any initial cost, and had to be carried through from beginning to end, as every original effort must be, regardless of ultimate cost. In the meantime, during the building of the machine, the members of the board did a great deal of independent work, largely preliminary, and often at their own expense. As before remarked, the unexpected disbursements required for the testing machine hampered the board from the start, for while a great range of experiments was possible independent of the testing machine, such as the breaking of full-size girders and trusses, they all required an expenditure in a large way. Still, much valuable work was done, far more than is popularly supposed, which has been admirably covered in a paper by Professor Thurston, read before the American Association for the Advancement of Science, at their Nashville meeting in the summer of 1877. This paper epitomizes the organization of the committees, with the work laid out for each, and the recapitulation in this place regarding the division of labor and the scope of the investigations programmed, will bear witness to the wisdom of the committee and serve to emphasize the previous remarks upon the importance of a National Testing Board for the industries of America. These committees were :

(A) ON ABRASION AND WEAR. *Instructions:* To examine and report upon the abrasion and wear of railway wheels, axles, rails and other materials, under the conditions of actual use.

(B) ON ARMOR PLATE. *Instructions:* To make tests of armor plate, and to collect data derived from experiments already made, to determine the characteristics of metal suitable for such use.

(C) ON CHEMICAL RESEARCH. *Instructions:* To plan and conduct investigations of the mutual relations of the chemical and mechanical properties of metals.

(D) ON CHAINS AND WIRE ROPES. *Instructions:* To determine the character of iron best adapted for chain cables, the best form and proportions of link, and the qualities of metal used in the manufacture of iron and steel wire rope.

(E) ON CORROSION OF METALS. *Instructions:* To investigate the subject of the corrosion of metals under the conditions of actual use.

(F) ON THE EFFECTS OF TEMPERATURE. *Instructions:* To investigate the effects of variations of temperature upon the strength and other qualities of iron, steel and other metals.

(G) ON GIRDES AND COLUMNS. *Instructions:* To arrange and conduct experiments to determine the laws of resistance of beams, girders and columns to change of form and to fracture.

(H) ON IRON, MALLEABLE. *Instructions:* To examine and report upon the mechanical and physical proportions of wrought iron.

(I) ON IRON, CAST. *Instructions:* To consider and report upon the mechanical and physical properties of cast iron.

(J) ON METALLIC ALLOYS. *Instructions:* To assume charge of a series of experiments on the characteristics of alloys, and an investigation of the laws of combination.

(K) ON ORTHOGONAL SIMULTANEOUS STRAINS. *Instructions:* To plan and conduct a series of experiments on simultaneous orthogonal strains, with a view to the determination of laws.

(L) ON PHYSICAL PHENOMENA. *Instructions:* To make a special investigation of the physical phenomena accompanying the distortion and rupture of materials.

(M) ON REHEATING AND REROLLING. *Instructions:* To observe and to experiment upon the effects of reheating, rerolling or otherwise reworking; of hammering, as compared with rolling and of annealing the metals.

(N) ON STEELS PRODUCED BY MODERN PROCESSES. *Instructions:* To investigate the constitution and characteristics of steels by the Bessemer, open hearth and other modern methods.

(O) ON STEELS FOR TOOLS. *Instructions:* To determine the constitution and characteristics, and the special adaptations of steels used for tools.

The committees being without funds, for reasons previously stated, were unable to do much more than begin their wisely-planned work, so that the board took measures early in 1876 to come before Congress for an additional appropriation, and reinforced by the moral support of leading scientific associations and schools throughout the country, asked for an appropriation of \$50,000 to continue their work. In July, the Senate added an amendment to the bill for sundry civil expenses of the Government, appropriating \$70,000 for the use of the Board to Test Iron and Steel. This was opposed by the House members of the conference committee, and the amendment was stricken out, and about the only satisfaction that could be obtained for the reason of the House opposition was in the remark of its chairman to a prominent engineer desiring light on the subject—"Can you tell me how many Democrats there are on that board?" The anxious inquirer left a sadder and wiser man, probably wondering if iron and steel had hitherto undiscovered political characteristics, as well as chemical and physical; if so, any board on testing the metals had a very large undertaking in hand, far surpassing that already laid out for investigation. A compromise amendment, however, was finally agreed upon, covering an appropriation of \$70,396.98, and at the same time legislating the board out of existence June 30, 1879. The work continued with the above financial support, and is a matter of record in the committee reports, for a summary of which reference is again made to Professor Thurston's review of the work of the board before noted. Strong efforts were successively made, not only to secure the repeal of the law discontinuing the board, but to continue

the appropriations as well. These efforts were not only cordially met by the then President, but made by him the subject of a special message to Congress; prominent Members of Congress made personal efforts to maintain the board as a national institution, and every possible argument was used for favorable Congressional action. All these efforts, however, failed, and the board was compelled to accept the inevitable and calmly resign itself to annihilation as its ultimate and speedy fate. In the year preceding the board's dissolution, the House, by resolution, called for a report of its work (no report up to that time having been presented). This report was subsequently presented to the House and ordered printed. In the debate upon the work of the board, the Speaker and former chairman of the Appropriation Committee, to whom allusion has been made, showed decided opposition to the board and its work, and presumably on the same ground. Finally, in June, 1878, the whole matter was settled by the passage of a law practically remanding the testing machine to the custody of the Ordnance Department, making it accessible for the service of private parties, and under a system of fees to cover the expense of operation and maintenance.

This, in brief, is a history of the rise, decline and fall of the United States Board for Testing Iron and Steel, from which much detail is necessarily eliminated, but exceedingly profitable for private examination and study. It belongs to the past and we must commence anew, referring only to so much of the past as will serve to enlighten the future. What is wanted now is a more comprehensive law for the proposed new board that is now creating the old, and one fully recognizing the national character of the work. To this end the powers of the board should be fully defined, and all necessary provision made for its successful operation. Such a board should not be tacked on in any way to an army department, but should be an independent creation reporting to the Secretary of the Treasury or the Secretary of the Interior. The work is almost entirely civil work, just as much as that of the Coast Survey, and should remain in existence as long as there is a metallic question, so to speak, remaining unanswered. Now that the testing machine is an accomplished fact, the board could profitably spend \$50,000 per annum in experimenting, and the center of its operations should be in the city of Washington, to which point the testing machine should be removed from Watertown Arsenal, its present abiding place. The operations of the board should be reported in a yearly volume, such volume being readily obtainable by the scientific men and metal workers of the country, either by sale for the mere cost of publication, or a proper system of distribution, whereby the object of its publication would be accomplished. There is a tradition that an edition was published of the only report made to Congress by the old board, which, if true, has most successfully failed to reach the very class of men who could profit by it, leading to a vague suspicion that its distribution was based on political and not scientific methods. If it is not possible under the existing methods of distributing public documents, to give the board absolute charge of distributing the yearly reports of their own work (and who, in the name of common sense, can better judge of where they should go), then the manner of distribution should be defined by the law creating the board. Too much attention cannot be paid to this branch of the board's work, since the very object of its creation would be defeated if the results of its work were not only accessible, but conveniently so, to all seeking such information.

We are now brought to the consideration of rather a delicate question, about which there are differing views, and that is the remuneration, if any, of the men engaged in the work of the board. This work, if properly followed up, would be an exceedingly engrossing one, calling for a practical abandonment for the time being of any other pursuit, and it would seem manifestly unfair to demand that such labor and sacrifice should be uncompensated. Again, the great majority of men qualified for such work (and there are not many such available) would be deterred from accepting service on the board, to whose work they would otherwise bring great enthusiasm and attainment, from sheer financial inability to perform uncompensated labor. Whatever is worth doing is worth doing well, and to expect qualified men to do thoroughly the work called for by such a board as is proposed, uncompensated—a work too, that will so richly compensate the American people—is expecting a degree of self-sacrifice that should not be looked for from this side of Utopia, and should not be asked for. The only objection possible to urge against a paid board, all or in part, is the one usually attaching to government salaried positions or appointments, and the possibility, therefore, of unworthy or incompetent appointments. In other words, that the board would get into politics, and that the question of the chairman of the House Appropriation Committee, before related, would be asked with redoubled earnestness. Be this as it may, it should be thoroughly understood that the moment the proposed board takes on a political bias, its usefulness is ended. Its aim is purely a scientific one for practical ends, and as such must be established on its merits alone, and if this view is not prominently kept in the foreground, and made the basis of all legislation concerning it, the whole matter had better be dropped. For can such a board lend itself to the glorification of any individual, or set of men, but working for the whole community, should, with genuine scientific enthusiasm, so conduct its work as to carry, with its yearly record of information gleaned and tabulated, the authority of the truth seeker, thus creating a standard of undisputed authority, accepted as absolute by the community at large. The work of such a board is not a matter of one year or two years; it may take ten years to cover the field as it should be covered; but whether it takes a longer or shorter time, it should be constituted on such a broad basis as to be freed from haste, in a thorough examination of the various schemes of experimenting it must necessarily undertake. We must not be impatient for results, but ever bear in mind that the ques-

tions asked by the modern engineer are exceedingly complex ones, and that, while he would have been content a few years back to know the amount of strain an iron bar, for instance, would stand before rupture, he demands now to know the reasons that cause different bars to yield different results, or the same bar to yield different results under varying treatment; or why a small bar should behave differently from a large bar of the same material. All such answers require a long series of experiments, and the gathering of information from actual experience, besides chemical examinations hitherto deemed unimportant; and in regard to steel, all that is known is so little compared to what is yet to be learned about its properties and adaptations, that the field of research is almost appalling in its magnitude and intricacy. When the work of such a board is completed, it would be a grand culmination of its work for the United States Government to officially promulgate as an American standard the limits under which American metals should be used, particularly in those works to the stability and endurance of which human life is intrusted; and while, perhaps, it would be straining a point to add criminality to a violation of such standards, the moral sense of the community would very soon attack such criminality, and bold would be the man, no matter how unscrupulous, to use metals excepting under the conditions officially prescribed. Science would have sway in the factories and workshops, and the days of the vendors of man-traps would be numbered—ignorance, if not eliminated, would be kept under wholesome restraint, and society would modify the field of that useful but dangerous member, in works demanding scientific knowledge, the "practical man."

The theme of the proposed "Board for Testing American Metals of Construction" is indeed an inspiring one, the far-reaching consequences being of vital interest to the American people. It is an endeavor, in the spirit of the age that is animating human thought in all parts of the world, to formulate exact knowledge, so that rules not only for safe practice, but intelligent practice, may be established. Engineering must ever advance toward ideal perfection, which is the perfect harmony between theory and practice, the closer union of which administrators to the necessities of mankind as well as to all wealth and luxuries—in a word, to the betterment of the whole human race. It is to contribute toward this goal as best they may that the American Institute of Mining Engineers meets on this occasion at the nation's capital, with Congress in session, to give voice to the one overwhelming topic among the engineers of America, in a firm reliance upon the patriotism, wisdom and conscience of the nation's rulers, believing in but one result, so soon as the boon they ask in the name of the American people is once fairly considered.

Then prove we now with best endeavor
What from our efforts yet may spring;
He justly is despised who never
Did thought to add his labors bring.
For this is art's true indication,
When skill is minister to thought;
When types that are the mind's creation,
The hand to perfect form has wrought."

Prof. T. Eggleston expressed his views briefly, dwelling more at length upon many difficulties encountered in the use of alloys, mentioning the cartridge manufacture as one in which the Government was greatly interested.

Mr. John Bogart, secretary of the American Society of Civil Engineers, read the following communication from Mr. G. S. Morrison concerning

I have had considerable experience with the testing machine at the Watertown Arsenal, having had broken there sixteen large steel eye bars, besides quite a number of iron bars and two compression members. So far as accurate and satisfactory results are concerned the machine is all we could ask for, and the officers who have it in charge, together with their civil assistants, are thoroughly conversant with its details and entirely competent to make the tests required. The principal defect is that the force is very inadequate. As the machine is arranged, the weighing apparatus is at one end and stationary, the measure of strain being carried from this to the scale beam by the fluid in a tube so small that it looks like a wire. At the other end is placed the hydraulic press, by which the power is applied, this press being mounted on a small carriage, and held by two 8-inch screws about 4 feet above the floor, which are, of course, strained in compression during tensile tests, and in tension during compression tests. When the stretch of the material has exhausted the throw of the plunger, it is necessary to relieve the strain, draw back the plunger, and move the carriage along, this being done by nuts, worked by steam, operating the large screws. Every specimen placed in the machine must be lifted above the large screws and lowered into position. To do this, crabs running on travelers which span the entire room, are placed over the machine, and by these the specimen can be lifted and put in place. The actual time required to make a test depends largely upon the amount of elongation of the material, but it may generally be said that for specimens which will stretch from 1 to 3 feet, the actual time will be from two to three hours. This is, perhaps, as fast as tests of this kind should be made, admitting the conduction of four tests per day, whereas the actual work done by the machine is not much more than one test per day, nine tests, as stated by Mr. Macdonald, having consumed seven and a half days. As the machine is now operated its actual capacity is about 350 tests of tension members per year, while it should be 1200. Compression members can be more rapidly tested, as the plunger carriage does not have to be moved. To get the full work out of the machine it is simply necessary to add to the present staff of skilled men, a force of unskilled men, who shall perform the different kinds of manual labor required, and get specimens ready during one test, so that the second specimen can be put in the machine as soon as the first is removed. They shall also perform after and before the regular working hours such work not requiring the immediate

supervision of the skilled men. The actual charge for use of the machine is now \$18 per day, besides a small charge for preparing the report on tests, and a charge for whatever expense is incurred in fitting the specimens. This charge is a very reasonable one, and, in the case of large steel specimens, like those which have been tested for me, it amounts to about one-quarter of the total expense of the test, the value of the bars destroyed and the miscellaneous charges for transportation and the like being about three times the actual charge for the test. In connection with a piece of work which I now have in hand, I have already had thirteen tests made, and shall have about the same number more before I get through, so that the tests made for this single structure will occupy the machine for about one month as it is now worked. As tests are now conducted, the record of tests is the property of the parties for whom they are made, special provisions having been made to prevent those tests from being published. To secure the fullest benefit of the machine all tests made ought to be published by the officers in charge for the benefit of all parties taking an interest in them, and the machine should be worked up to its full capacity. As the apparatus is the property of the Government, even if the present charge, which is little more than the cost of working the machine, is maintained, the public are justified in demanding that the results of its working shall be given to them. In the matter of the use of steel for structural purposes this machine is almost indispensable. The two points which must be considered in introducing a new material for structural purposes are, first, its capacity for use, and, second, its ability to stand abuse. The capacity for use is measured by the elastic limit of the material, which is the real measure of strength to which the factors of safety should be applied; the ability to stand abuse is determined by the behavior of the material after the elastic limit has been passed; and while this forms no measure of the strain which may be put upon the material, it would determine absolutely whether the material is fit for structural purposes or not. A material like glass, which is destroyed as soon as its elastic limit is passed, is wholly unfit to sustain strains in construction. The old-fashioned high-carbon steels had the same character, and the material now demanded for structural purposes is a material which shall stand a great distortion after passing the elastic limit and before rupture. The machine at the Watertown Arsenal is the only one now in existence which will determine these results on bars of the size which it is desirable to use in structures of such magnitude that it is important to use steel in them. This machine has a capacity of 800,000 pounds, and in the course of my experiments I have had occasion to work it, in several instances, to over 700,000 pounds. When it is remembered that about two-thirds of the whole stretch is accomplished during the application of the last 5000 pounds per square inch, and that this stretch and reduction of section at point of fracture are the best measures of the ability of the material to stand abuse, the importance of these tests is at once apparent. Although I have had a number of full-sized steel bars strained beyond the elastic limit in other machines, I have not yet found a machine which would break, or even develop any considerable part of the stretch in any of the larger sizes of the bars which I have used. When it is remembered that the cost of making steel now but slightly exceeds, and will probably soon be less than, the cost of manufacturing wrought iron, and that the elastic limit, which is the true measure of strain which may safely be applied, is about one-half greater, even in the lower and softer steels, than that of the best wrought iron, the importance of a complete set of experiments which will develop the ability of steel to stand, and so prove its adaptability to the purposes for which wrought iron is now used, can hardly be overestimated. At present it is considered best to limit its use to those parts of structures which are least liable to sudden shocks and irregular strains, though it can hardly be doubted that a steel will soon be made of such uniformity and toughness that it will be preferred to wrought iron for all uses.

Mr. Percival Roberts, Jr., of Philadelphia, gave some striking instances of the unreliability of testing iron and steel by the ordinary methods, and, as will be seen from his paper, which we here give, showed in what an unsatisfactory state the testing of materials was at the present time. Mr. Roberts's paper is as follows:

MR. PRESIDENT AND GENTLEMEN: I desire to present this evening a few brief notes from the standpoint of a manufacturer upon the subject of tests and testing of iron for structural purposes, not that I have any new facts to which to call your attention, but simply to review a few of the very objectionable features of present modes of operation, and the dire necessity for important and very radical changes. At the present time, as most of you are well aware, proposals for materials are accompanied by certain specifications, to which in quality and tests the manufactured article is to conform. Evolved in many cases from the inner consciousness of some one more expert in theory than in practice, we find a few of them to be good, many bad, and some indifferent, no two agreeing in any particular excepting their dissimilarity. Appended are a few of those of the most prominent engineers and railroad companies, and which may be taken as representing the best and most intelligently framed specifications which we now have, and yet in some points scarcely satisfactory, not from any fault of their authors, but entirely due to misunderstanding arising from tests as now made. To instance the very varied opinions held as to proper quality for bridge work, I would note two lots of iron of which tests had been made by inspectors, and the results referred to the maker with the following comments:

Size.	Red. Area.	Elongation.	Break Ld.
1 1/4 in.	26%	25%	53,500
Gent 120° around 1 1/2-inch bar with fracture.			
Size.	Red. Area.	Elongation.	Break Ld.
1 7/16 in.	24%	24%	48,320
Gent 120° around 2 inch wide. This run should			

bend 180° without fracture and is therefore rejected.

LOT NO 2—TEST OF IRON FOR BRIDGES—ALL MEASUREMENTS TAKEN UPON A PARALLEL SECTION OF 10-INCH IRON FOR TENSION MEMBERS.

Size, Inches.	Break strain per sq. in.	Elongation, Per cent.
1 5/8	49,500	20
1 3/4	57,000	27
3 1/2 X 1	49,500	20
3 1/2 X 1 5/16	48,120	20 1/2
3 1/2 X 1 1/2	48,000	13.1
3 1/2 X 1	48,000	25

NOTE.—The bar iron was all too soft, hence lacked strength; test showed this—they bent 120° without fracture.

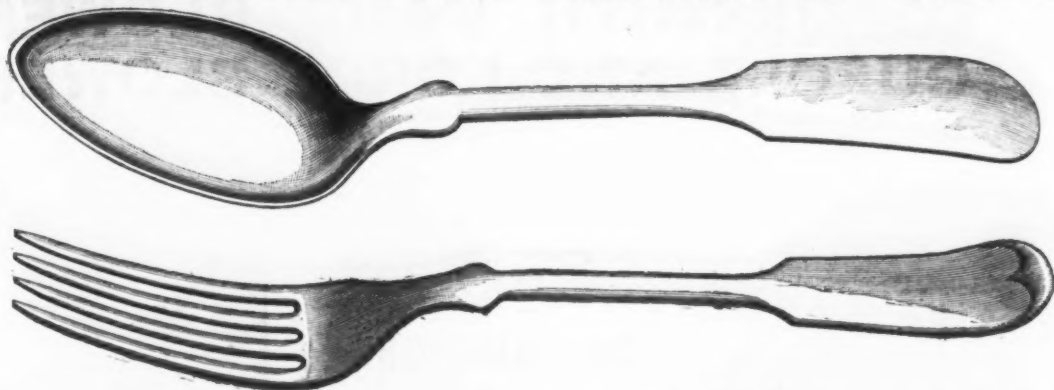
By this we may see the very diverse opinions of engineers upon the qualities suitable for structural material. Again, to illustrate the very peculiar position in which manufacturers are placed by this conflict of opinion, let me quote from the charge of Judge McKenna to the jury in a case brought before the United States Circuit Court, and growing out of a condemnation of material furnished by the Messrs. Atkins, of Pottsville, to the Edge Moor Iron Co. for the New York Elevated Railroad. I quote as follows: "There is no doubt about the fact that this iron was to be used in a structure of a particular character; that it was a particular kind of iron, and that certain qualities were essential to the value of it in such use. It will hardly be said that a man who was making a contract for angle iron of certain dimensions, and was told that it was to be used in a particular construction, such as this, for instance—over which it was to bear heavy weights; over which locomotives and passenger trains were to be carried—it would hardly be fair to assume that the parties intended that iron which would be suitable for use in a bridge over which people were to walk merely should be furnished. Therefore, it is that the rule which I have stated is founded upon sound common sense; that where parties come together and make a contract in reference to a particular thing, and they both understand that it is intended for a particular use, that something which is not at all adapted to that use is not to be supposed to have been the subject of the contract between the parties. In a bargain and sale of an unmanufactured article, which the seller is informed at the time of the contract is intended for a special purpose, there is an implied warranty that the article to be furnished is fit for the special purpose intended by the buyer. In such case the buyer necessarily trusts to the judgment or skill of the manufacturer. The law implies a warrant on the part of these plaintiffs, that the iron furnished by them under their contract should be adapted, in quality and otherwise, to such intended use; I do not understand that there is a serious contest here as to the quality of this iron. It was merchantable iron."

Here we have it distinctly set forth that, there being no written or express agreement between the parties as to the quality of the material, it must be furnished subject to its intended use. But who the judge of its fitness? What the criterion of its quality? when we are dependent upon a standard as shifting as opinion without proof can make it. To illustrate once more a difficulty which at present occurs, I have upon the wall a memorandum of tests made upon some flats 12 inches wide, which were intended to meet requirements of Pennsylvania Railroad specification, namely, ultimate tensile strength, 46,000 pounds; elastic limit, 23,000; stretch, 15 per cent. in 8 inches. Two bars 12 x $\frac{1}{4}$ inches, and one bar 12 x $\frac{1}{2}$ inches were taken at random from a large number; a piece 10 feet long was cut from each one and sent to Watertown Arsenal; from each one also a piece 16 inches long was taken and divided up the center, one-half being sent to Fairbanks and remainder retained at Pencoyd. From each of these pieces, namely, 6 x $\frac{1}{4}$ inches and 6 x $\frac{1}{2}$ inches, five test pieces were cut, being about 1 inch wide, and tested with result shown in following table:

TENSILE TESTS OF 12" HIGH PLAT BARS.									
Bar.	Marked.	Area In sq. in.	Elong. In. In eq. in.	Brk. 1d. In eq. in.	Stretch $\frac{1}{2}$ in 8 in.	Stretch $\frac{1}{2}$ in 10 in.	Stretch $\frac{1}{2}$ in 80 in.	Centn of area, %.	Tested by
12" X 12"	1	50.18	33.568	45.619	13.04	Pennord.
"	2	7200	29,275	44,714	8.59	Pennord.
"	3	7200	30,678	45,285	8.59	Pennord.
"	4	6797	38,240	46,270	13.27	Pennord.
"	5	719	35,085	44,579	6.45	Pennord.
"	937	719	35,085	44,579	6.45	Pennord.
"	813	9.00	32,880	46,544	10.37	Walters.
"	1-1	5831	39,703	47,390	12.40	16.3	15.20	32.0	Walters.
"	2-1	7548	30,990	45,453	8.59	Pennord.
"	3-1	7548	30,990	45,453	8.59	Pennord.
"	4-1	7548	30,990	45,453	8.59	Pennord.
"	5-1	7548	30,990	45,453	8.59	Pennord.
"	6-1	7548	30,990	45,453	8.59	Pennord.
"	7-1	7548	30,990	45,453	8.59	Pennord.
"	8-1	7548	30,990	45,453	8.59	Pennord.
"	9-1	7548	30,990	45,453	8.59	Pennord.
"	10-1	7548	30,990	45,453	8.59	Pennord.
"	11-1	7548	30,990	45,453	8.59	Pennord.
"	12-1	7548	30,990	45,453	8.59	Pennord.
"	13-1	7548	30,990	45,453	8.59	Pennord.
"	14-1	7548	30,990	45,453	8.59	Pennord.
"	15-1	7548	30,990	45,453	8.59	Pennord.
"	16-1	7548	30,990	45,453	8.59	Pennord.
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From the results we see that a great want of uniformity occurs. By the Watertown tests the bars would be accepted, while by Fairbanks' results two would be rejected. Some pieces by the Pencyod tests would accept the bars, while others taken beside them would condemn them. The elastic limit in both Fairbanks and Pencyod results is probably too high, owing to method of observation. The 12 x $\frac{1}{2}$ -inch bar at Watertown yielded through a blister, which opened at 31,000 lbs. per square inch, which accounts

HALL & ELTON'S GERMAN SILVER.



In addition to Spoons of this well-known brand, we are now prepared to furnish Forks of the same quality. We GUARANTEE these goods to be SOLID and of UNIFORM quality throughout, with no coatings to wear through or flake off, and with no liability to RUST.

HALL, ELTON & CO., Wallingford, Conn., and 75 Chambers St., New York.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

Finest Quality Silver-Plated Spoons, Forks, Knives, &c.



NOTICE.—We guarantee the base of our Spoons, Forks, &c., to be full 12 per cent. Nickel Silver, and extra heavily plated with pure Silver. Our goods are all hand burnished, and are first-class in every respect. We pack our Spoons and Forks one dozen in each box.

49 CHAMBERS ST., NEW YORK. } Factories, } 18 FEDERAL ST., BOSTON.
WATERBURY, CONN.

Escutcheon Pins, Small Rivets and Screws,

And Specialties in this line made to order by

BLAKE & JOHNSON,
WATERBURY, CONN.

S. B. 1800. M. L. B. 1845. M. L. B. & CO. 1856. B. & A. 1867. B. & A. 1881.

BRADFORD & ANTHONY,

BOSTON, Mass.

Continue with a fuller stock than ever before the business which has been conducted without interruption for eighty-one years, as

IMPORTERS, MANUFACTURERS' AGENTS,
AND WHOLESALE DEALERS IN
American, English, German, French and Swedish

CUTLERY, SKATES AND FISHING TACKLE.

Sole selling agents for the United States for **ENGSTROM'S SWEDISH RAZORS**.
Sole selling agents for the United States for Starr Man'g Co.'s **ACME SKATES**.
Sole selling agents for **WINSLOW'S POPULAR SKATES**, Wood Tops, Clubs, All Clamps, and Ladies' Skates, Popular Roller Skates, Park Roller, Improved Circular Running Vineyard Rollers.
Sole selling agents for **ROBERT MURPHY'S** Corkscrews, Oyster Knives, Shoe Knives, Rubber Knives, Butter and Cheese Trenches and Steel Implements.
Sole selling agents for **D. ROBERTS'** Nickel-plated and Japanned Handle Shears and Scissors.
Sole selling agents for New England, for **H. HEINICH'S SONS'** American Shears, Scissors and Trimmers.
Sole selling agents for New England, for the **STAR SCISSORS COMPANY'S** Nickel-plated Ladies' Scissors, Trimmers, &c.
JOHN RUSSELL CUTLERY CO.'S Table Cutlery, Pocket Knives, Butchers', Painters', Druggists' and Household Cutlery, Silver-plated Forks and Spoons.
JOSEPH RODGERS & SON'S Table Cutlery, Pocket Knives, Scissors, Razors, Erasers.
GEORGE WOSTENHOLM & SON'S Celebrated IXL Pocket Knives, Razors, Farmers' Knives.
JONATHAN CROOKER'S Pocket Knives.
WADE & BUTCHER'S Celebrated Razors.
FREDERICK REYNOLDS' Razors.
THOMAS R. CADMAN'S BENGALL Razors and Razor Blanks.
NEEDHAM BROTHERS' "Repeat" Pocket Knives.
Sole selling agents for **NEW ENGLAND KNIFE CO.'S** Pocket Knives.
Sole selling agents for **BARCLAY & BROS.** Pocket Knives, Scissors.
Sole selling agents for **BARBER BROS.** Pocket Knives.
JOHN NOWILL & SON'S Scissors.
JAMES CHESTERMAN & CO.'S Measuring Tapes.
Sole selling agents for **HADGER'S RAZOR STRAPS**.
Sole selling agents for **UNITED STATES FISH HOOK WORKS**.
Sole selling agents for the **FISHING LINES** bearing the Trade Mark, "Best Quality Hand Laid Linen and Silk Lines," which received Centennial Medal for "strength and care taken in manufacture."
Sole selling agents for the **Patent Adjustable Floats and Sinkers**.
Importers of **Calcutta and Japan Bamboo Poles, Fish Hooks, Swivels, Silver Fishing Gimp, Spanish Silk Worm Gut**.
Selling agents for the **Best Manufacturers of Jointed Fishing Rods, Braided Fishing Lines, Fishing Reels, Artificial Baits, Patent Pocket Flasks, Hammocks**.
COMPRISED IN ABOVE ARE
More than 1130 Different Patterns of **POCKET KNIVES**.
More than 500 Styles and Sizes of **SCISSORS AND SHEARS**.
More than 150 Patterns of **RAZORS**.
More than 750 Kinds of **TABLE CUTLERY**.
And all other articles of **CUTLERY** in great multitude.
And over 445 Kinds and Sizes of **FISHING LINES**.
55 Patterns (over 950 Different Kinds and Sizes) of **FISH HOOKS**.
155 Styles of **Fishing Rods**. 120 Patterns **Fishing Reels**. 350 Varieties of **Artificial Bait**.
List of **Murphy's Steel Goods**, catalogues of our **Skates**, catalogues of our **Fishing Tackle Stock** will be mailed on application to dealers in these lines of goods.
See Copartnership Notice on Page 29.

BRADFORD & ANTHONY, Boston, Mass.

for low tensile strength of this bar. By these results a very surprising want of uniformity is made manifest.

We have, as it were, broken chips and from them concluded the strength of timbers. Small samples of 1 square inch area or less and a few inches long have given us what we know of sections for structures of many times that area and length. In too many calculations has one square of section been of one value, no matter what its shape or the area of the piece employed. It may be well laid down as an axiom that in bars of iron, whether round or flat or square, the element of non-uniformity varies as the square of the sectional area. It is generally considered that iron of an average quality is capable of sustaining an ultimate stress of 50,000 pounds per square inch. A bar of a sectional area of 1 square inch should, and no doubt will, stand the above, but we err if from this we conclude that one of 6 square inches will do the same. There is one point which cannot be too strongly urged upon all employing wrought iron for structural purposes, and that is, to pay especial attention to the shape of the section upon which they are calculating strains. The bar of 1 square inch, whether round, flat or square, will give probably the same result, but put the same quality of iron into a wide thin plate, angle or channel, and a very different result may be obtained. It is, I think, much the same as if the material of a rope was placed in such a form that all the fibers did not sustain an even share of the strain and, consequently, some being overtaxed yield first, causing rupture at a lower point than had they all borne an equal proportion of the load. We pay too great attention to ultimate breaking strength at the expense of the other far more important qualities of elastic limit, reduction of area and stretch; for strain a piece beyond its limit of elasticity and it is only a question of time when its failure will occur. I have very hurriedly and imperfectly shown a few of the disadvantages under which both the buyer and the manufacturer labor at the present day, owing to the methods of testing now employed. To whom shall we look for a remedy, and by what means? Briefly I answer, to the Government of the United States. Testing machines such as the one now at Watertown, capable of testing the largest sections of iron and steel as rolled or forged, should be erected at the principal manufacturing centers. Tests then could be made quickly as material is furnished by the mills. The testing also will be in the hands of competent persons, who, engaged in this work alone, will be much better fitted to conduct tests than those who now in many cases undertake them as a very unimportant fraction of many other duties. Upon these machines, meanwhile, let experimental researches be conducted by properly appointed commissioners, among whom I deem it very essential that the manufacturer have a place. To the engineer, no doubt, belongs the determining of strains and the calculation of parts, but very many points will arise in the course of these investigations which can best be answered by one thoroughly acquainted with the practical working and details of manufacture. As a result of this research I would suggest the framing of a standard set of specifications for tests to which iron and steel for structural purposes should be subjected. We have our standard weight and measures, why not our standard tests? Let us sweep away all the conflicting specifications we now have, and in their stead place one in which we have a reasonable faith, it being based upon experiment, not theory. I believe by so doing a better manufactured article would be obtained, as mixtures of iron would not so continually be changed to give one a little more elasticity or another a trifle less stretch. This matter of Governmental action is one of vital importance. Year by year the employment of metal in place of wood for structural purposes is increasing in an enormous ratio, and we are ignorant, very ignorant, as to what we are using and the strains which it will sustain. The thrilling story of another bridge disaster chronicled over the world by the daily press bears a more eloquent testimony to this fact than any words of mine. It is not in the interest of any one section of the country or class of people that the aid of the Government is invoked. The expense to be incurred in these investigations is far too great for any individual corporation to bear, and the importance of the result is national. The citizen of San Francisco who may travel to New York is as much interested in the safety of every bridge upon his route as he who lives beside it all his life. A beginning has been made. The testing machine now in operation at the Watertown Arsenal is a monument to American engineering and common sense, and is it to be but labor wasted? Are we, for want of a small sum of money, to lose results which every year will more than repay their cost. Gentlemen, I feel that, could this whole matter be placed before Congress in its proper light, but little delay would be experienced in prompt action upon the subject, and to that end I would urge you all to do what may lie in your power.

In concluding the session, President Metcalf remarked that no useful knowledge of materials could be obtained by the present system of conducting tests, as the history of manufacture was entirely unknown. As an instance, he mentioned the fact that at one time a gun, reported to have a considerable strength (the exact figure has escaped my memory), burst after having been discharged but a few times. Portions of the fragments, when tested, showed the reported strength of the metal to be correct, and everybody was at a loss to account for the unexpected failure excepting the manufacturers, who had observed a flaw in the metal. Such apparently mysterious failures are thus, in many cases, readily accounted for by the maker, who, however, is naturally not disposed to betray the facts, which would detract from the merits of his productions.

(To be continued.)

In 1880-81 the Angleur Steel Works, Belgium, turned out 47,440 ingots of steel, or 11,829 tons more than the corresponding production of 1879-80. The quantity of finished iron and steel in 1880-81 amounted to 37,985 tons.

WASHINGTON NOTES.

(From Our Own Correspondent.)

WASHINGTON, D. C., March 1, 1882.

The case of Kennedy, importer of hoop iron cut and punched, against the Collector of Customs at Philadelphia, recently decided by Judge McKennan in favor of the importer, and ordered December 14 last by the Secretary of the Treasury to be taken to the Supreme Court of United States, has just reached that tribunal and now stands at the foot of the docket. The entry reads as follows: "1199. Attorney General—John F. Hartman, Collector of Customs at the port of Philadelphia, plaintiff in error—Eastern Pennsylvania Circuit Court of the United States—L. P. Kennedy, trading as Kennedy & Brother."

It is evident that the Secretary of the Treasury proposes to push this question ahead as rapidly as possible. Ordinarily the appeal would not be returnable until the term of October, 1882, and would not be likely to reach the court until that time. If this case were to take its regular turn on the docket, it would not be reached for at least three years. It has been customary, however, for the court in revenue and other important Government cases where the questions involved were of sufficient importance to the Government, to advance them, so as to bring them to immediate trial. Whether this can be done at the present term of the court, which will last until May, is a question to be determined. It is known that the court had decided before this case was entered on the docket, to advance no more cases at the present term. No less than six cases were thus declined. Should Secretary Folger see fit not to make the request, or should the court decline, there could be no contingency which would bring this case up for argument before next October. It will be remembered that this case involves the duty on hoop iron for cotton ties of a certain description, and which Secretary French decided were dutiable at the specific rate of 1½ cents per pound, instead of the ad valorem rate of 35 per cent.

Judging from the petitions which are being presented by representatives from the inland States, which have hitherto been rather disposed to favor free trade, the cause of protection of home manufactures and labor is taking firm hold upon the working masses. A few days ago Representative Springer, of Illinois, submitted a petition from the workmen in various industries of Springfield, petitioning for the earliest consideration and prompt passage of the bill introduced by Hon Wm. McKinley, Jr., of Ohio, fixing the rates of duty on manufactures of iron, steel, &c. They represent that the prompt passage of this bill is a simple act of justice, already long delayed; that for the protection of their labor and that of their fellow-workmen the tariff laws now on our statute books were enacted; that through a failure in the wording of these laws to clearly define their true intent and meaning there has grown up, under the action of the so-called "omnibus clauses," a body of decisions hostile to the spirit of these acts, contradictory and unjust, and injurious to those they were designed to protect. These decisions have substituted ad valorem for specific duties, inviting undervaluation and fraud on the revenue. They have reduced the duties on many articles below those levied on the materials of which these articles are made—a clear violation of the spirit of this as well as of other tariff acts—and as a consequence of these decisions and their results, American labor and American capital have many times been thrown idle, and compelled, at great loss, to seek other employment. To correct these decisions, to provide for the enforcement of these acts in their true spirit and intent, to give to American labor what these laws intended should be given it, we earnestly pray you that the above-mentioned act be passed promptly, and that no amendment or addition be allowed to jeopardize the immediate placing on the statute books of this act of justice. This petition is signed by upward of 300 workmen.

Some weeks ago the Secretary of the Treasury authorized the publication of the point of the decision in the steel bloom case. The following is the full text, just completed by the Secretary, showing the reasons by which he reaches his conclusions in the matter of

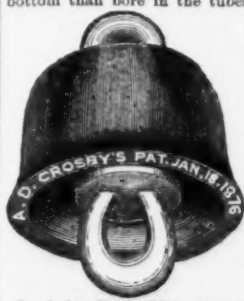
THE APPEAL OF JAMES LEES & CO.

On 21st September, 1881, the appellants brought from over the sea, into the port of New York, 410 pieces of metal, weighing in all 160,720 pounds, or, on an average, 392 pounds each, and worth less than 7c. per lb. These pieces of metal are stated to be 6 inches square, by which I understand that that is the size at the end of the piece. The length is not shown, but it is conceded to be from 2 to 3 feet. They were called by the appellants "steel blooms," the assistant appraiser called them "steel blooms," the collector of the port called them by the same name. There is no other fact stated in the papers before me from which I can gather the characteristics of these pieces of metal. It may be assumed that they were pieces of steel which had reached some stage of the manipulation between the first combination of the kinds of matter that went into the composition of steel and the final act by which it is turned out as an article for the practical use of mankind.

What was that stage? The only indications to me of what it was is the name given to the articles by all who had actual knowledge of them. They called them "steel blooms." Now, it is contended by some that there is no form or stage of steel at which it is properly known as a "steel bloom." I do not think that this contention can be maintained. It is true that it was not until 1867, or thereabouts, that the name of "bloom" was applied to steel; yet since that time it has come into general commercial and manufacturing use, and is a phrase as common as most others in the "customs" vocabulary, and frequent in the mouths of business and practical men. The word "bloom" was before the year 1867 in practical and legal use. It was applied to iron as descriptive of it in a certain stage of manipulation, and is used in the Tariff Act of 1864 (see Schedule E, paragraph 68 of "The Tariff Indexed," 1880). As applied to iron, it designated that metal as in a stage

The Most Durable and Best Selling Bucket for Chain Pumps.

It has no valves to become obstructed and no screw joints to become immovable by rust. Advantages of the Crosby Bucket over all others:—1. It has an air chamber on top, which conducts the air to the bottom of the well. 2. It is self-expanding, the base of the bucket being ¼ of an inch larger at the bottom than bore in the tubes, which allows it to expand, and the groove in the side to contract. 3. The wear comes on the whole side, and not on the extreme edge like other buckets. 4. It contains more solid rubber than three of any other manufacture. Three sizes—1¼ inch for deep wells, 1½ inch for 40 feet or less, 2 inch for stock pumps. No charge for Territorial Rights.



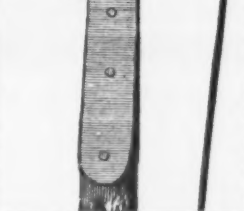
Send for Price List. Agents wanted in every county. Address A. D. Crosby, Patentee and General Agent, Cuba, Allegany county, N. Y. For Sale by W. & B. Douglas, 31 and 33 John St., N. Y., and all General Hardware and Pump Dealers.

Something Practical at Last!

WATERS' Improved TREE PRUNER.

E. S. Lee & Co. Sole Manufacturers, ROCHESTER, N. Y.

We are now exclusive manufacturers of this celebrated Tree, Shrub and Hedge Trimmer. Special inducements to buyers for export. Send for our illustrated circular and price list. E. S. Lee & Co., Rochester, N. Y.



GLADWIN IMPROVED BIT OR AUGER.

This Bit will bore through all hard, knotty or gummy woods without being withdrawn. The worm will not clog, owing to the continuance of the channel of the Bit to the extreme point of the worm, enabling it to cut its way and clear itself of shavings, but not injuring its qualities as a screw. This improvement is applicable to any size Auger or Bit having a worm or spur. Dealers, send for price list for getting stock on hand (stating quantity and sizes) and for the Gladwin Bits. GARDNER & CHANDLER, Gen'l Agents, 1321 Washington St., Boston, Mass.

THE ECLIPSE WAGON JACK

is the SIMPLEST, CHEAPEST and most CONVENIENT in the market. It will raise a 2000-POUND wagon, and is made of the best hard wood, riveted with iron rivets. The BEARING on the bottom is LONG, and the JACK remains FIRMLY in place in use. A SAMPLE will be sent upon receipt of \$1.00. LIBERAL DISCOUNTS to the Trade. Sole Agent, T. C. CONWAY, 88 Chambers St., New York

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PORTABLE FORGES. BLACKSMITH HAND BLOWERS. CUPOLA AND FORCE BLOWERS.



ALL SIZES AND STYLES,

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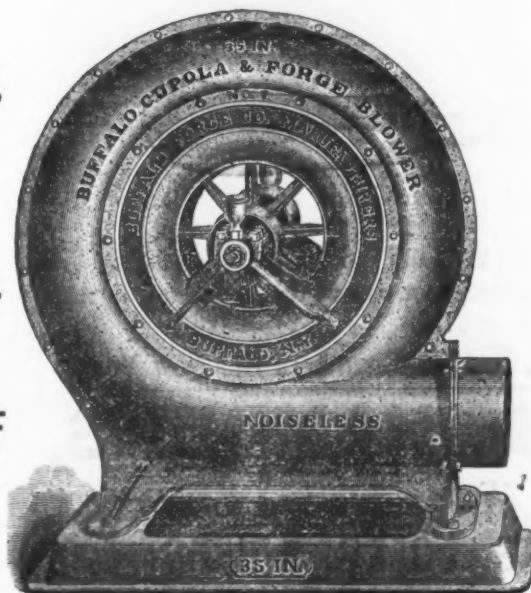
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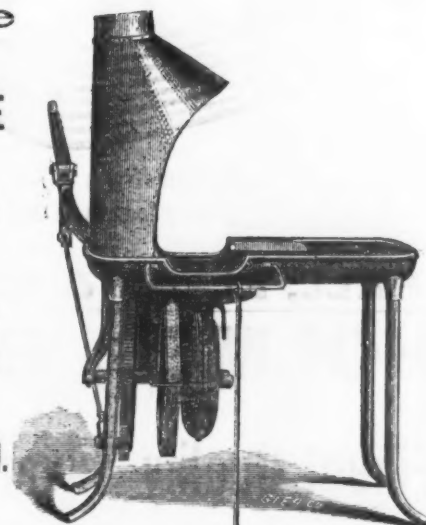
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BUFFALO GAS HEATING FLAT IRONS.



FOR

TAILORS, DRESS AND CLOAK MAKERS,

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Most Convenient, Economical and Labor Saving Iron in the Market.

BUFFALO FORCE COMPANY,

Sole Manufacturers, BUFFALO, N. Y.



We have invented a new style of Knife Handle, and applied for a patent on same. It is light, exceedingly strong, and can never get loose. We have plated this knife with a composition plate, and we warrant it to wear as long as the VERY BEST silver plate, and to look as well after two months' use. The price is so extremely low that the poor need scour knives no longer. We have for three years warranted our Butcher Knives to be superior to any other Butcher Knives on earth, and this warranty has never been disputed to our knowledge by anybody who has ever tried them, and our statement about these knives will prove equally reliable. We will send 12 knives and 12 forks by mail, postpaid, on receipt of \$3. We make a very handsome Butter Knife, heavily plated with silver, at an exceedingly low price. We also make a full line of Hot Water Proof Table Cutlery, which has very rapidly gained in popularity for the past three years, and is having an unprecedented sale at the present time. We make eleven different styles of Carvers. The cutting quality of the blade is the same as that of our Butcher Knives. The fork guard is patented by us, and made by nobody else, and is highly admired by the trade. We are having a large sale now, but we desire to increase it. Give us a chance to prove our statements.

GOODSELL COMPANY, Antrim, N. H.

PECK'S PAT. DROP PRESS
BLAST FORGES
STEEL & IRON DROP FORGINGS.
Drop Dies and Special Machinery.
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DUNNING FINISHED STEEL HORSE SHOES.

THE MOST POPULAR AND ECONOMICAL HORSE SHOE IN THE WORLD!

The Chicago Steel Horse Shoe Co.,

SOLE MANUFACTURERS,

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These shoes may be ordered in single or assorted sizes from the leading Hardware houses East or West. Among whom are:

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Dunning Sizes.....4, 6, 8, 10.
Correspond with Iron Shoe, 2, 3, 4, 5.



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PECK & GODDARD,

SOLE AGENTS

FOR ALL STATES EAST OF OHIO.

60 Liberty St., New York

These shoes are forged from a solid bar of steel. Afford a natural, even bearing for the foot. They will cure corns and improve tender feet. Being a finished shoe it only requires the work of shaping and nailing on.

Send for sample keg (100 lbs.) assorted sizes.

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Hibbard, Spencer & Co., Chicago, have sold our Casters as follows:

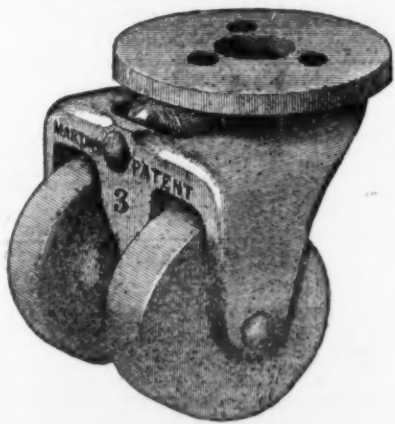
1879.....\$322.60
1880.....590.92
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Melson, Matter & Co., Grand Rapids, Mich.:

1879.....\$64.60
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We have just issued a new Catalogue, which we would be pleased to mail with terms upon application.

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Manufacturers,
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QUEEN CITY MALLEABLE IRON CO.

Make all Shapes and Sizes of

Malleable Iron Castings

known to the trade. Our specialty is

WELDING MALLEABLE CASTINGS.

Guaranteed to weld perfectly and capable of being drawn under a hammer. Address,

N. W. Corner Vine and Second Streets,
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ALL THAT THE NAME IMPLIES.

It Stands Unrivaled and Alone!

Peerless Clothes Wringer!

IT LEADS THEM ALL.

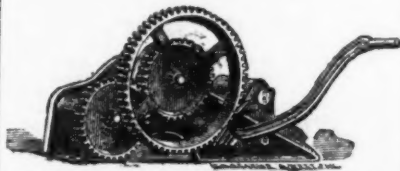
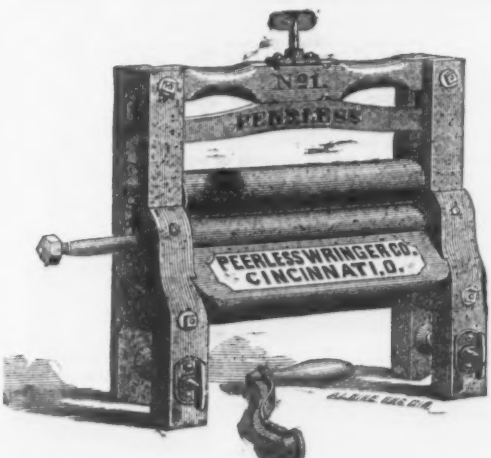
More of these Wringers are sold to the Trade than any other Wringer in the market.

Sold by all the Principal Jobbing Houses in the Country.

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Cincinnati, Ohio.

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Quick Adjustable Tire Bender.

The best and cheapest arrangement for bending tires in the market. Simple in construction, adjustable to any size of tire.

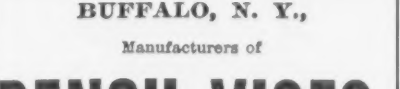
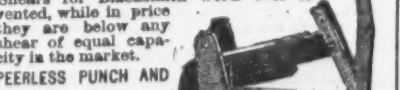
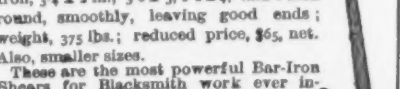
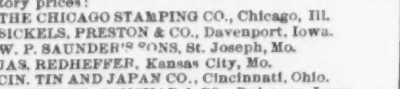
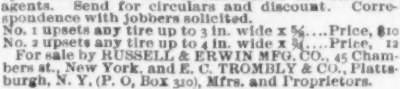
No. 1 bends any tire up to 4 1/2 in. wide.....Price, \$10.00
No. 2 bends any tire up to 5 in. wide.....Price, 12.00

Improved Automatic Tire and Axle Upsetter.

The most perfect machine for upsetting or shrinking wagon tires, axles, braces, &c., ever placed in the market. Every blacksmith should have one. They are cheaper than any other machine, and one man operates it alone. Liberal discount to the trade and agents. Send for circulars and discount. Correspondence with jobbers solicited.

No. 1 upsets any tire up to 3 in. wide x 5/8 in. Price, \$10.00
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less finished than when in bars, and more advanced than when in pigs. So that the word "bloom" is a word of manufactures, commerce and statutory law, and may be used; and I must conclude that when it is coupled with the word "steel," it is used to carry from mind to mind the notion of steel in some stage of manipulation of it for the ultimate practical use of mankind. Now, what is the notion thus conveyed? As I gather it from the assertions and concessions made in the argument before me, and from statements drawn from men engaged in the working of ores and metals, it is this: The first form of steel, as it comes from the mold or jacket, is that of a large lump or block, and it is then known and described as an ingot, which, being reheated, is divided into parts, which are put under pressure or the blows of hammers, whereby their structure is somewhat changed, in that they are compacted, lengthened in texture and strengthened. The idea of the material in that changed state is now conveyed, when it is spoken of as a "steel bloom," so that it may be taken for the purpose of this decision that a "steel bloom" is a piece of steel, not in its first state, but changed and improved therefrom, in the second of the processes, more or less continued, that are needful to bring the metal from what may be called its raw condition to one for immediate use for some purpose of mankind.

The articles brought in by the appellants were "steel blooms." What duty should have been charged upon them? There is no mention of a "steel bloom" in the Tariff Act. This, however, is not conclusive that there is not a rate of duty especially fixed by that act upon that article. It matters not by what name the article is brought in, if within the fair purview of that act it is there specifically pointed out; and though the lawmaker may not have used the same name as the maker or importer of the article, if in the law the article is clearly included in any name as subject to a particular duty, that duty will be charged upon it. The Tariff Act is concise in its mention of steel, and fixes duties in the particular and in the general. The particular duties needed to be here named are only these:

1. Steel in ingots, bars, coils, sheets, * * * valued at 7 cents per pound or less, 2 cents and 1/4 per pound * * * (Tariff Act as indexed § 117.)

It is clear that the steel in this case was not in sheets or coils. And though the assistant appraiser has classified it as steel in bars, it was not contended in oral argument before me, that it is to be so held. I am informed, also, that the word "bars," in the passage above quoted, has been interpreted to mean the finer steel, designed for the making of tools and nicer implements; that better kind of steel being known as bar steel. And it is suggested that that officer so classified, rather by assimilation (under § 2499 Rev. St.), than as matter of fact. Moreover, the Tariff Act recognizes a difference between bar steel and steel railway bars. (Act indexed § 92.) There remains then only the term "ingots," in the above quotation from the Tariff Act. And the stress of the oral argument before me was that steel in the form now designated as "steel blooms" is truly "steel in ingots." Indeed that was stated, in answer to an inquiry made by me, to be the gist of the argument. I have stated above what is an ingot of steel and what is steel in bloom. It seems they are not the same precisely in form, though there is a general likeness therein; and it is plain that an important change has been made in the substance. At least one step has been taken that has improved, if not changed the character of the material. The material is no longer the ingot, which is the first state of the article steel—the crude state, so to speak—but it is in an advanced state wherein by manipulation there has been added value to it, and it has been brought into a condition recognized in the markets as different from the ingots, both in appearance and in quality. The taking of that step has produced an article from the steel (the steel crude, to use that word) that did not exist before that step was taken. Something has been made from steel that has a distinctive and important place in commerce. That steel in this condition was not known by the name of "steel bloom," is not conclusive that it was meant by the Tariff Act to include it in the term "ingot," as, in the first place, the latter term had then an application, in fact and in commerce, to a distinctive article; and, in the second place, other phrases are used in the act that may take in the article under consideration. And it is worthy of notice that, though the ingot is applied sometimes to a piece of steel after it has been manipulated to some extent, as above stated, it is generally found in company, in the application, with some word that is expressive of the treatment that the material has received, as cogged ingots, hammered ingots, rail ingots, or the like, showing thereby that the term "ingots" alone does not convey the full idea of the state of the steel after it has been reheated in the ingot and submitted to pressure, or to hammering. Therefore, I do not think that it was meant by the word "ingot" in the act to describe steel in the state in which it is left by the treatment above set forth.

2. I find, too, in the Tariff Act, that provision is made for "steel in any form, not otherwise provided for." (Act indexed § 120.) Now, the phrase "in any form" is not to be restricted to shape and proportions, but it is to be interpreted as having the meaning of "any kind or description." I have shown, I think, that steel blooms are not the same description of steel as ingots, and I might then inquire whether they would not fall within the last-quoted clause. But as no one strenuously contends for that, and the decisions of this department have not gone that way, I will form no opinion, nor intimate any therein. Besides, those decisions were made upon the question directly presented to some of my predecessors, that this article fell under that clause. If it had been held that it did, the duty to be exacted would be lower than that which has been imposed. But it was held that it did not, and a higher duty than that prescribed by that clause was collected. For me now to reverse that holding, and to rule that this article fell under that clause might be to make a reversing decision adverse to the Government, and, as I understand, I am forbidden by statute to do that, except in the

way prescribed by the Act of March 3, 1875, §§ 1, 2, 4.

3. I also find in the Tariff Act that provision is made for "all manufactures of steel." (Tariff indexed § 91.) A steel bloom, as described, is not a finished manufacture of steel; that is, it has not been carried to the completed state. There is more to be done to it to produce an article that will in its final shape enter into prolonged use in that shape. It may be more properly said, however, to be in a shape that is a making of an article composed of steel. (See act indexed § 91.) There has been in the producing of it a manufacture of steel; something has been produced from steel that did not before exist in that state and condition of that particular body of steel.

I understand that the previous decisions of this Department on the somewhat varying phases of this question have gone on one or other of these grounds or both of them. I am satisfied with my conclusion, that the "steel blooms" in this case are not to be classed as ingots or bars, under § 117 above quoted, and that, therefore, the action at the Appraiser's Office, at the port of New York, was mistaken, and that the appeal should be sustained. I am not so entirely clear as to what clause of the Tariff Act is controlling in the case. But as the action of the department has for some time been to direct the duties to be fixed on "steel blooms" at 45 per cent. ad valorem, as I may not without reversing former decisions adversely to the Government put them under any lower clause, and as the course of business has been in accordance therewith and no amendment of the Tariff Act in contradiction of that action has been made, I will adhere thereto. Accordingly the officials at New York will be directed to exact duties at that rate upon the goods of the appellants involved in this case. To prevent misapprehension, I will speak of a former decision of this department akin to that now made. I mean S. S. 4999. As to change the rule there laid down to accord with my view of the general subject would be to make a ruling adverse to the Government, from which I am precluded by positive provision of law, as above stated, that decision must be still followed as a guide by customs officers. It may not be easy to apply these rulings, in the cases that now exist, or that will arise, so as to make them harmonize, but it is to be expected that the attention of Congress will be given to this subject, the sooner and the more earnestly from the evidence that is now given of the practical difficulties that have arisen in administering the law under varying conditions of fact.

CHAS. J. FOLGER,
Secretary, &c.

DISPUTES IN CUSTOMS REVENUE CASES.

Senator Sherman has intimated that he will press his bill to facilitate the decision of controverted questions in customs revenue cases, now in the hands of the Finance Committee, for early consideration. In view of this impracticable, complicated and absurd proposition, the Board of Trade of Philadelphia, through Representative O'Neill, has submitted to the House of Representatives a memorial representing that the bill, Sec. 630, to facilitate the decision of controverted questions in customs revenue cases, "would, if enacted, be vexatious and unfair to importers, because (first) it transfers such controverted questions from the places where such questions arise and where the evidence in relation thereto can be readily obtained and used, to a distant place where the production of such evidence would be difficult and expensive, and (secondly) because the said bill provides for appeals from the decisions of customs officers only to the Secretary of the Treasury, under whose rules the said officers act, or to the court of claims, where all testimony must be presented in writing and where a trial by jury (which is the right of American citizens) cannot be had. For these and other reasons, this Board of Trade believes the said bill to be unreasonable and unfair, and the board, which includes in its large membership only a small number of importers, does, nevertheless, now and hereby remonstrate against the passage of the said bill, and prays that the same be rejected." The memorial is signed by John Welsh, president, and Geo. L. Buzby, secretary, of the board.

The adoption of such a measure would include such cases as have recently been before the Secretary of the Treasury, like steel blooms, hoop iron, &c., and would give the manufacturers interminable worry and annoyance. The following are the salient features of the bill:

The first section provides that the appeals provided for by sections 2931 and 2932 of the Revised Statutes may be made by the appellant, at his election, either to the Secretary of the Treasury or to the Court of Claims, to be there proceeded with, determined, and disposed of as suits against the United States; and so much of said sections as relates to bringing suits for the recovery of duties alleged to have been erroneously or illegally exacted is repealed.

The second section provides that the Secretary of the Treasury may transfer to the Court of Claims, without his decision thereon, any such appeals made to him, to be there prosecuted in the same manner as if they had been made directly to said court in the first instance.

Section 3 provides that every appellant to the Court of Claims shall enter his appeal in said court within thirty days after the taking thereby, by filing a petition in writing against the United States setting out the facts, &c. The Court of Claims shall have the same power and proceed in the same manner as in the adjudication of claims against the United States; *Provided*, That in the trial of such appeals no person shall be excluded as a witness because he or she is a party to or interested in the same.

Section 4 provides that the Attorney-General of the United States shall defend the United States against all appeals from customs officers prosecuted in said court, and on appeal in the Supreme Court, in like manner as he is now by law required to defend the United States, with the same power to interpose therein counter-claims and offsets and defenses for fraud practiced or attempted, and all other legal defenses.

Sections 5, 6, 7 and 8 provide the details governing the trial of such causes. The whole system is cumbersome, and should be antagonized by every interest affected.

HOWARD IRON WORKS,

BUFFALO, N. Y.,

Manufacturers of

BENCH VISES,

Price Lists sent on application.

sure is formed into a solid, impermeable fabric, which, after being fastened to the roof, is finished by a coating of Granite Cement and sanded. Thus a good, substantial, yet light and good-looking, roof is obtained, which will last for twenty years, if the same care is taken of it that is given to tin roofs.

IRON.

American Pig.—The tone of the Iron market is quiet along the entire line, and buyers do not come forward in anticipation of future requirements, but are satisfied with a hand-to-mouth policy. The consumption of Pig Iron continues on a large scale, and the deliveries on old contracts are said to be very heavy and sufficient to prevent any accumulation on furnace banks. The tone of the market has lost none of its strength so far as the raw article is concerned, and we repeat former quotations, viz.: Foundry No. 1 X, \$26.50 @ \$27; Foundry No. 2 X, \$25; Gray Forge, \$24.

Scotch Pig.—The demand for foreign Iron was light during the week, and prices of some brands are not as firm as of late. Sales are reported of 100 tons Eglinton at \$24, 100 tons Glengarnock, and about 400 tons various brands, in lots, at our quotations. We quote: Eglinton, \$24 @ \$24.50; Carnbroe, \$25; Coltness, \$27 @ \$27.50; Glengarnock, \$25 and Gartsherrie, \$26 @ \$26.50.

Rails.—Nothing in the way of new business in either Steel or Iron Rails has been announced since our last writing, and the tone of the market is more in buyers' favor. Steel Rails are quoted nominally, \$57 @ \$60 at mill, but rumors of lower figures are current, and \$55 is talked of as the probable price at which a desirable order might be placed. Iron Rails are neglected, and we quote them nominally, \$48 @ \$50 at mill.

Old Rails.—We hear of a sale of a small lot of Bridges at \$32.50, and 500 tons Double Heads at \$31.75 f. o. b. cars at Jersey City. The market is void of animation and prices are a shade easier. We quote T's, \$29.50 @ \$30, and D. H., \$31.50.

Scrap.—Wrought Scrap, to arrive, is quoted \$31.50 @ \$32. We have not heard of any transaction worthy of mention.

METALS.

Copper.—Sales for the week have summed up some 200,000 pounds of Lake Copper at 19 1/4¢ @ 19 1/2¢, closing firmer at 19 1/4¢. Baltimore is worth 19¢. Nothing transpires in futures. The chief mines are not anxious sellers of Copper at anything under 20¢, whereas manufacturers, still sufficiently stocked, show indifference. London cable Best Selected \$74 yesterday, and Chili Bars \$65. We are reported from London per cable to-day: "The market is quiet, with moderate business doing; Best Selected, \$71." The import of Copper into the United States has been:

1881.	1880.
Lbs.	Lbs.
280,679	4,161,664
Less re-export.....	251,890
Net import.....	31,789
Equal to tons.....	240
DOMESTIC EXPORT.	
1881.	1880.
Lbs.	Lbs.
7,034,775	326,252
Equal to tons.....	2,140

Manufacturers have made no change in prices. They quote: Bottoms, 31¢ @ 32¢; Braziers, 30¢ @ 36¢; Circles, 33¢ @ 36¢; Sheathing, 28¢, and Bolt Copper, 30¢; Segment Sheets, 33¢; Fire-box ditto, 30¢.

Tin.—The market has been quiet and steady at 25 1/4¢ for Straits; Biliton and Australian, 25 1/4¢, large lots; English Refined and Common, 25 1/4¢, and Banca, 29¢. A year ago Straits Tin was worth 19 1/4¢; in 1880, March 1, 22 1/4¢; in 1879, 15 1/4¢, and in 1878, 14 1/4¢. According to Messrs. Wm. I. Russell & Co., 12 Cliff street, New York, the stock at New York and Boston is 1387 tons, and there are about 2070 tons, constituting a visible supply this day of 3457 tons. London quoted per cable yesterday \$111.15/16 Straits Tin, Singapore, \$35 1/2 picul, and Penang, \$34.50. Shipments from Singapore to the United States have been 145 tons during the latter part of February, making 420 tons for the month. February deliveries have been 1300 tons in England and Holland jointly, against 1000 in January. Consumption in the United States from January 1 to March 1, 1882, is estimated to have been 1500 tons. The Biliton sale came off yesterday, 13,000 piculs, averaging 77.25 guineas, which is equal to \$116, cost and freight in Holland, and 26¢ laid down here. The import of Tin into the United States has been, in hundredweights:

1881.	1880.
Lbs.	Lbs.
28,164	256,021
Less re-export.....	25,839
Net import.....	2,325
Equal to tons.....	7,875

We are reported from London per cable: "The demand fell off during the week and prices are weaker. We quote Straits, spot, \$111.10/16, and futures, \$113.5/16. Tin Plates.—The week has been quiet and a disappointment. We quote at the close, large lines, ordinary brands 2 1/2 box, Charcoal Bright, \$6.25 @ \$6.50; ditto Termes, \$5.37 1/2 @ \$5.62 1/2; Coke Tin, \$5.20 @ \$5.35, and ditto Termes, \$5 @ \$5.12 1/2. England cable a quiet market yesterday at 10/ for Coke, and 21/ for Melyn grade Charcoal. The import of Tin Plates into the United States has been, in hundredweights:

1881.	1880.
Lbs.	Lbs.
3,660,136	3,160,076
Less re-export.....	9,797
Net import.....	3,650,339
Equal to tons.....	127,517

We are reported from London per cable: "The demand is small and prices are weaker."

Lead.—The market has been quiet, nothing but a retail trade transpiring at \$5.15 @ \$5.20 for Common. Refined has been active at 5 1/4¢, nominally. St. Louis reports by mail, February 25: "Lead opened lower and dull; sales of special brands hard early in the week at \$4.85, and Refined at \$4.87, but a firmer feeling manifested itself later on. To-day seven cars hard, special brand, sold at \$4.90." Since this was written freight from East St. Louis has risen to 35¢ per 100 lb. equal to 35¢ from St. Louis. Yesterday London cable cost, freight and insurance, £15. 2/6, which is equal to \$4.30 here. The import of Lead into the United States has been, in pounds:

1881.	1880.
Lbs.	Lbs.
7,800,126	6,418,017
Less re-export.....	961,797
Net export.....	6,838,329
Equal to tons.....	2,555

We are reported from London per cable: "The market is quiet, with a steady demand, and prices are firm. English Pig, Common, £14. 12/6." There has been no change in manufacturers' prices. We quote: Pipe, 7 1/2¢; Sheet, 8¢; Tin-lined Pipe, 15¢, and Block, 35¢; all less 10¢ to the trade.

Spelter and Zinc.—The Spelter market has been dull, manufacturers being provided for the time being. Some small lots were meanwhile pressed on the market and sold at a trifle under current quotations. We nevertheless quote Common Domestic, 5 1/2¢ @ 6¢, Silesian being nominally worth 5 1/2¢. The latter is still cabled firm from Breslau at figures forbidding its being laid down at New York at anything below 5 1/2¢. The import of Spelter into the United States has been:

1881.	1880.
Lbs.	Lbs.
5,111,093	6,160,651
In sheets.....	2,760,790
Less re-export.....	5,187,991
Net import.....	8,160,382
Equal to tons.....	3,543

We are reported from London per cable: "The market continues quiet and prices are steady. Ordinary, at shipping port, £16. 17/6 @ £17." Sheet Zinc is quiet at 7 1/2¢.

Antimony.—We have ascertained that the consumption of this metal is 100 tons per month in this country, toward which the Sonora Smelting Company, of California, furnished, during 1881, 30 tons monthly. This supply, obtained from Sonora (Mexico) ore, smelted in California, has now fallen out, and as Antimony smelted from Nevada ore is but a small affair, our supply has to be drawn almost wholly from England. Hence the firmness of the Cookson and other English brands. We quote: Cookson, 15¢ and Hallett, 13 1/4¢.

OLD METALS, PAPER STOCK, &c.

The purchasing prices offered by dealers are as follows:

Copper, heavy.....	10¢ @ 16
" light.....	10¢ @ 14
Copper Bottoms.....	10¢ @ 14
Yellow Metal.....	10¢ @ 14
Brass, heavy.....	10¢ @ 14
Brass, light.....	10¢ @ 14
Composition, heavy.....	10¢ @ 14
Lead, heavy.....	10¢ @ 14
Zinc.....	10¢ @ 14
Pewter, No. 1.....	10¢ @ 14
Wrought Iron.....	10¢ @ 14
Light do.....	10¢ @ 14
Stove Plate.....	10¢ @ 14
Grate Bars.....	10¢ @ 14
Electrotype plates.....	10¢ @ 14
Small type.....	10¢ @ 14

The prices current (prices paid by local dealers) for Rags, &c., are as follows:

Canvas Linen.....	10¢ @ 16
White Cotton.....	10¢ @ 14
White, No. 1.....	10¢ @ 14
Second.....	10¢ @ 14
Soft Woollen.....	10¢ @ 14
Mixed Rags.....	10¢ @ 14
Gunny Bagging.....	10¢ @ 14
Butte.....	10¢ @ 14
Kentucky Bagging.....	10¢ @ 14
Book Stock.....	10¢ @ 14
Newspaper.....	10¢ @ 14
Waste Paper and Scraps.....	10¢ @ 14
Kentucky Bale Rope.....	10¢ @ 14

FOREIGN TRADE MOVEMENTS.

The following is a summary of foreign trade movements for the past week:

1880.	1881.
Total.....	\$7,848,377
Prev. reported.....	\$7,771,929
Since Jan. 1.....	\$6,630,800

Included in the foregoing were articles of merchandise valued as follows:

Quantity.	Value.
Avails.....	435
Brass goods.....	38
Bronzes.....	5
Chains and Anchors.....	48
Clocks.....	29
Copper.....	3,600
Cutlery.....	189
Guns.....	2
Gas fixtures.....	75
Hardware.....	468
Iron, pig, tons.....	4,070
Iron, sheet, tons.....	60
Iron, other, tons.....	2,515
Machinery.....	270
Metal goods.....	210
Needles.....	36
Nickel.....	13
Old metal.....	5,737
Pipe.....	2
Plating.....	5,954
Plated ware.....	16
Perforated caps.....	12
Saddlery.....	14
Spelter.....	23,974
Steel.....	15,790
Steel pens.....	3,842
Silverware.....	3
Tin, bbls.....	6,245
Tin, slabs, 1550.....	61,709
Wire.....	39
Zinc.....	17,801

The following are the imports of leading articles, compared with previous dates:

For the week of 1882.	8 weeks of 1881.	Same time 1881.
Cutlery, pkgs.....	783	1,236
Hardware, pkgs.....	7	195
Iron, R. R., bbls.....	29,929	7,723
Lead, pkgs.....	3,689	

EXPORTS OF SPECIES.

For the week ended Feb. 25:

Total.....	\$1,709,563
Previously reported.....	7,831,177
Total since January 1, 1882.....	\$8,709,740
Same time in 1881.....	1,920,709
Same time in 1880.....	1,370,592
Same time in 1879.....	3,073,166
Same time in 1878.....	2,151,090
Same time in 1877.....	2,899,514
Same time in 1876.....	7,888,281
Same time in 1875.....	13,555,809
Same time in 1874.....	5,566,870
Same time in 1873.....	11,235,042
Same time in 1872.....	2,810,367

EXPORTS EXCLUSIVE OF SPECIES.

For the week ended Feb. 28:

Total.....	\$5,293,440
Previously reported.....	\$8,588,255
Since Jan. 1.....	\$47,745,114

EXPORTS

Of Hardware, Iron, Machinery, Metals, &c., from the Port of New York, for the Week ending February 28, 1882:

Hamburg.	Quant. Val.	Bilbao.	Quant. Val.
Sew. ma., cs.....	215 \$1,000	Pt. m., gals. 112,320	\$8,400
Pt. m., gals. 905,810	70,622	Argentine Republic.	
Revolvers, cs.....	5 3,642	Hdw., pkgs.....	55 530
Ag. imp. pkgs.....	15 1,381	Tacks, cs.....	62 200
Mach'y, pkgs.....	31 5,448	Ag. imp. pkgs.....	510 11,550
Clocks, bxs.....	69 1,370		
Shavers, bxs.....	45 570		
Ag. imp. pkgs.....	3 779		
Mf. iron, pkgs.....	85 1,272		
Knit mach., cs.....	25 2,800		
Hdw., pkgs.....	10 535		
Pig. res., pkgs.....	4 600		

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EXPORTS

Of Hardware, Iron, Machinery, Metals, &c., from the Port of New York, for the Week ending February 28, 1882:

<i>Bristol.</i>			<i>Mf. iron, pkgs</i> 91 894			Ta
ch'y, cs....	4	125	Ag. imp. pkgs	4	30	
m. gals. 270,251		10,650	Cutlery, cs...	16	393	Th
cks, bxs...	37	442	Hdw., pkgs...	9	540	Vo
<i>Liverpool.</i>			<i>Mexico.</i>			
ns, cs....	4	792	Ag. imp. pkgs	88	957	

THE OUTLOOK

as not changed in any material degree—the date of my last, such alterations as have been recorded having been for the most part unimportant. It is worthy of note, nevertheless, that these few changes have been almost wholly in a downward direction, so that, even if of no particular moment *per se*, they have their mission as living indications of the direction in which the wind blows. As regards the open markets there is nothing specially new to note, other than that almost all kinds of crude irons have become slightly weaker, inasmuch, there can be no doubt, by the movements at Glasgow. It had been somewhat confidently anticipated that the extremely favorable nature of the Board of Trade returns for January, the greater ease and stability of the money market, and the settlement of the iron-workers' strikes in the north of England would have had the effect of increasing the value of pig iron, as well as imparting an improved tone to the markets in general. This anticipation has not been fulfilled, however, owing, in all probability, to a strong bear movement at Glasgow, the continuance of high freights and the consequent small shipments. The result, at all events, is, as stated, and at the time of this writing crude irons are weaker and in a more unsatisfactory condition than at any time these two months. Even in Cleve-



BIT BRACES FOR 1882.

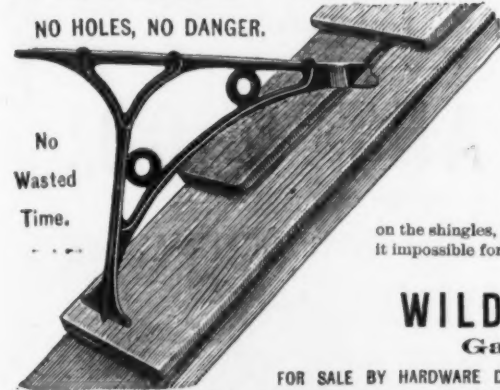
After having made almost every kind of a Bit Brace and tried them on the market, we find that our BARBER IMPROVED BRACE, as seen in this Cut, is the only one which gives universal satisfaction. During the past six months we have made some slight changes on this Brace, which remove all objections to it and make it absolutely perfect. We are aware that other Braces are sold at a less price, but they are also made at a less cost. Everything which goes into the Barber Brace is of the best and most expensive quality, and one of them will outlast six of any other kind. The Sweeps and Jaws are of steel, the Head of lignumvitæ and Revolving Handle of rosewood. It is highly polished and heavily nickel plated. The Jaws will hold, without any fitting, Tool Shanks of every shape, including Round Twist Drills. When furnished with the Ratchet Attachment, for boring in places where the Sweep cannot be revolved, it is the only Brace which will answer that purpose. We have not changed the price for many years, and do not anticipate any change in the near future; but from year to year we have been adding to the quality so as to make the cost to us double what it was ten years ago. We have recently added to our manufacturing facilities, and are now prepared to supply the world with Braces.

LIST PRICES.

No. 10—14-inch Sweep, per dozen...\$33.00	No. 14—6-inch Sweep, per dozen...\$21.00
No. 11—12-inch Sweep, per dozen... 30.00	No. 31—12-inch Sweep, per dozen... 39.00
No. 12—10-inch Sweep, per dozen... 27.00	No. 32—10-inch Sweep, per dozen... 36.00
No. 13—8-inch Sweep, per dozen... 24.00	No. 33—8-inch Sweep, per dozen... 33.00

MILLERS FALLS CO., 74 Chambers St., New York.

PATENT ROOF BRACKET.



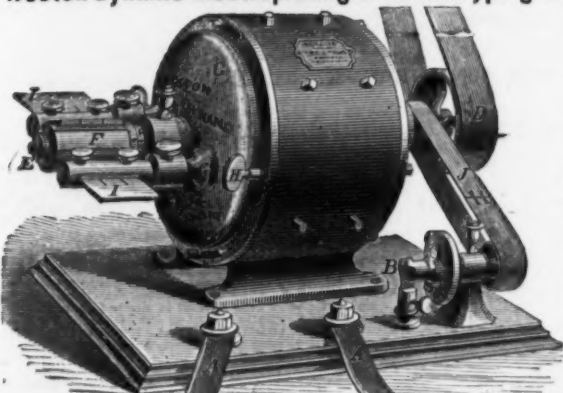
For Carpenters, Painters, Masons and Firemen.

The shingle on this side being left out, the operation of the Bracket can be easily seen. It slides in between two shingles, with the foot slightly raised, two ears going under the shingles and two over; when the foot is pressed down the ears take a lever nip on the shingles, which, with the spur on the foot, makes it impossible for the bracket to come off.

MADE BY
WILDER MFG. CO.,
Gardner, Mass.

FOR SALE BY HARDWARE DEALERS GENERALLY,
WILLIAM BLAIR & CO., Chicago; HOWELL, GANO & CO., Cincinnati,
Wholesale Western Agents.

HANSON & VAN WINKLE, Sole Agents for
Weston Dynamo Electroplating & Electrotyping Machines, Newark, N. J.



For Nickel, Bronze, Brass, Copper and Silver Plating.
Over 1000 machines in use.
Are used by all leading stove manufacturers.
Experienced men sent to put up machines and instruct purchasers.

INFRINGEMENTS.
We call attention to infringements of the Weston Machine in which Automatic Switches are used to prevent change of current. The Weston Co. are owners by grant or purchase of all forms of Automatic Switches for Plating Machines. The adoption of these machines will certainly lead to great loss to parties purchasing or using them.

MANUFACTURERS OF
Cast Nickel Anodes, Pure Nickel Salts, Polishing Materials.

Manufactory, Newark, N. J. New York Office, 92 & 94 Liberty St.

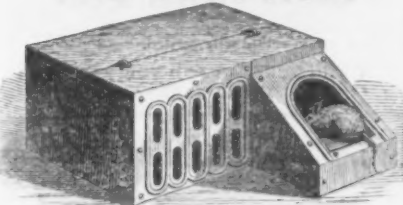


WITH SHELL EJECTOR
30, 32, 38 and 44 Cal.
Pocket, Police, Navy and Army Sizes
Also, Double and Single Shot Guns,
Rifles, Cartridges, Shells, Bullets,
Primers, Loading Implements,
&c., &c.

Send for reduced catalogue and discounts of goods manufactured by
E. REMINGTON & SONS,
283 Broadway, NEW YORK.

THE DELUSION.

THE GEM CARPET STRETCHER.



Patented June 8, 1880.
The Best and Cheapest in Use.
DIRECTIONS.—Tack the carpet at one side of the room, then go to the other side, and with the stretcher draw the carpet into place, leaving the spur a few inches from the base-board. Take up the slack in the carpet under the spur and drive the spur gently into the floor; it will hold the carpet in place while you drive the tacks. Manufactured by

CLAUDIUS JONES & CO., Erie, Pa.

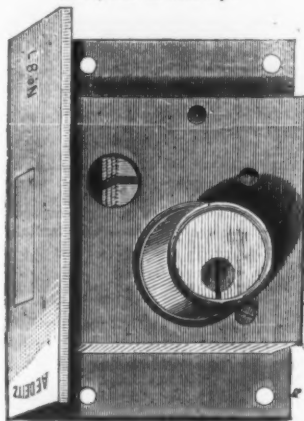
CHARLES H. HOWELL & CO.,

MANUFACTURERS OF FIRST QUALITY

PAINTS, COLORS, OILS, VARNISHES, DRYERS.

212, 214 & 216 Race St., Philadelphia, U. S. A.

A. E. DIETZ,
(Successor to Barnes & Deitz.)
Manufacturer of
Store Door Locks, Night Latches, Padlocks, Drawer Locks,
&c., with Flat Steel Keys.



Durrie & McCarty, Agents,
97 Chambers & 81 Reade Sts., New York.

THE FORSYTH SCALE CO.,
YOUNGSTOWN, O.,
Manufacture a full line of

FORSYTH'S STANDARD SCALES
Counter, Portable, Dormant,
Stock and Hay, and
R. R. Track
SCALES.

Call Special Attention to their
SUSPENSION HAY & R. R.
TRACK SCALES.

Also, Warehouse Trucks and Letter Presses.
PRINCIPAL WAREHOUSES,
DURRIE & McCARTY, New York;
FORSYTH SCALE CO., Chicago;
SIMMONS HARDWARE CO., St. Louis.

PRIZE MEDALLISTS:

Exhibitions of 1862, 1865, 1867, 1872, 1873, and only award and medal for Noiseless Steel Shutters at Philadelphia, 1876; Paris, 1878, and Melbourne, 1881.

CLARK, BUNNETT & CO.,
LIMITED,

Late CLARK & COMPANY,
Original Inventors and Sole Patentees of
Noiseless Self-Coiling Revolving
STEEL SHUTTERS,
FIRE AND BURGLAR PROOF. ALSO IMPROVED
ROLLING WOOD SHUTTERS,

Of various kinds. And Patent
METALLIC VENETIAN BLINDS.

Endorsed by the
Leading Architects of the World.
Send for Catalogue.

Office and Manufactory,
162 & 164 West 27th St., N. Y.

The "Salem" Elevator Bucket.

FIRST PREMIUM AT THE

MILLERS' INTERNATIONAL EXHIBITION.

What Users Say of It:

"We consider the 'Salem' the 'Best in the market.' What better testimonial can you have than the size and frequency of our orders?"
THE LINK BELT MACHINERY COMPANY, Chicago.

"We find the 'Salem' to be first-class in every respect."
R. D. HUBBARD & CO.,
Mankato, Minn.

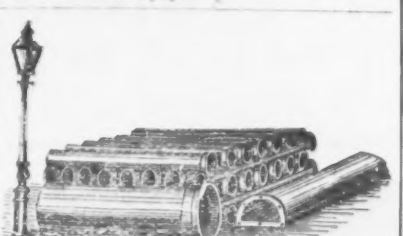
"We like the 'Salem' Bucket. Ship us 55 more at once."
STRAITSVILLE CENTRAL MINING CO., Columbus, O.

"It is nearer Perfection in every respect than any other Bucket made."

SAMPLE MAILED FOR 15 cents (stamps).

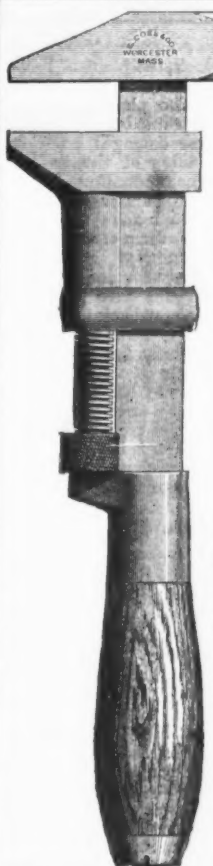
W. J. CLARK & CO., Sole Mfrs.,
Salem, Ohio.

New York Office, 78 Beekman Street.
Please name this paper.



R. D. WOOD & CO.,
Philadelphia,
Manufacturers of

Cast Iron Pipe
FOR WATER AND GAS,
Lamp Posts, Valves, &c.,
Mathew's Pat. Anti-Freezing Hydrants,
400 CHESTNUT STREET.



L. COES'
Genuine and Mechanics
PATENT
Screw Wrenches
MANUFACTURED BY
L. COES & CO.,
Worcester, Mass.
ESTABLISHED IN 1830.

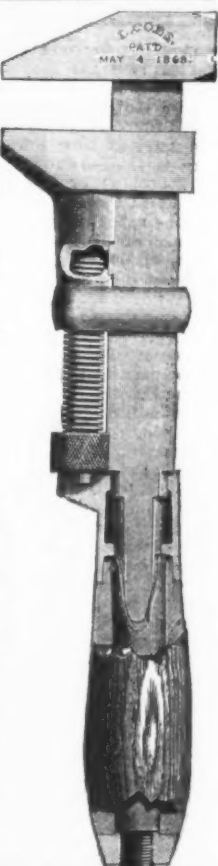


Our Genuine Wrenches are made with straight bars, full width and enlarged jaw, having ribs cast inside, which strengthen the jaw and give a full bearing on front of bar. These improvements, in combination with our new ferrule, made with double bearings, an iron tube, fitted to the shank and resting against the lower bearings, rigidly held in position by the handle and nut, effectually preventing back thrust of ferrule (see sectional view), verify our claim that we manufacture the heaviest and strongest Wrench in the market. None genuine unless stamped.

L. COES & CO.,
Worcester, Mass.

Warehouse,
97 Chambers and 81 Reade Sts.,
NEW YORK.

DURRIE & McCARTY,
Sole Agents.



The 1882 Pennsylvania Lawn Mower.

OUTSTRIPS ALL COMPETITORS. PREMIUMS TAKEN OVER ALL OTHER MOWERS.

EVERY MACHINE WARRANTED TO WORK AS REPRESENTED.



Also Manufacture the
BEST 10-INCH FORWARD CUT LAWN MOWER in the MARKET, named "OUAKER CITY."

For descriptive catalogue and prices write to
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DURRIE & McCARTY, New York.
AMES PLOW CO., Boston, Mass.
PRATT & CO., Buffalo, N. Y.
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DUCHARME, FLETCHER & Co., Detroit, Mich.
LOCKWOOD, VAN DOREN & TAYLOR, Cleveland, Ohio.
ANDERSON HARDWARE CO., Indianapolis, Ind.
WM. FRANKFURTH & CO., Milwaukee, Wis.
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LLOYD & CLARKE, La Crosse, Wis.
T. M. CLARKE & CO., Atlanta, Ga.

CHAMPLAIN Forged Horse Nails.

MANUFACTURED BY THE
NATIONAL HORSE NAIL CO.,
Vergennes, Vermont.

HOT FORGED AND COLD HAMMERED POINTED. MADE OF BEST NORWAY IRON AND WARRANTED.

A full line of "CHAMPLAIN" and "NATIONAL" Nails always on hand at our Warehouse,
97 CHAMBERS AND 81 READE STREETS, NEW YORK.
DURRIE & McCARTY, Sole Agents.

NEW ENGLAND BUTT CO.,

Manufacturers of
Drilled Cast Butt Hinges
IN GREAT VARIETY.

New England Gate Hinges. Sad Irons, Polishing Irons.
Woolman's Self-Closing Gate Hinges. Mrs. Cook's, McCoy's and New England Polishing Iron.
Barn Door Hangers, Rolls & Rail. Laundry and Tailors' Irons,
Sliding Door Rolls and Way. Tailors' Box Irons.
Butterworth Window Springs. Detachable Handle Sad Irons.
Grindstone Fixtures. Waffle Irons.
Patent Saw Clamps. Foot Scrapers.
Patent Floor Jacks. Patent Foot Scraper and Cleaner.
Cistern Tops and Covers. Braiding Machinery for Silk, Worsted
Stair Rail, Store and Fancy Brackets. or Cotton, and for covering
Harness Hooks and Brackets. Whips and Telephone Wire.
Flush Pulls, Small Anvils, Dumb Bells. Fine Castings a specialty.
WORKS AT PROVIDENCE, R. I.
New York Office, 99 Chambers Street.
BOSTON AGENTS—NASHUA LOCK CO.



VARIETY IRON WORKS.

KYSER & REX,

Manufacturers of
Hardware Specialties, Iron Toys, Novelties
and Housefurnishing Hardware,
Main Office and Factory, Trenton Ave. and Margaretta St., Frankford, Philadelphia
Branch Office, 19 & 21 S. 4th St., Phila. Hardware specialties manufactured to order.

same points, for one man, or class of men, at a less rate than they exact from other and competing interests; if they could lawfully require one man to pay fifteen cents per bushel for the transportation of wheat from Cleveland to New York, while they did the same service for another and rival merchant for ten cents; or bring hither merchandise for certain favorite firms and refuse to carry for others, they could make and unmake the fortunes of whomsoever they chose. Railroads, whose capacities for good and evil were not fully comprehended a quarter of a century ago, are now regarded as essential to the rapid development and prosperity of the country. No one can at this time successfully compete in manufacturing, mining, or in commercial pursuits, without the use of railroads. They have pretty much superseded any other means of inland transportation; and if their manipulators are authorized for any reason, sinister or otherwise, to invidiously discriminate against one man or community in behalf of other and rival interests, they would be in possession of a power which, skillfully exerted, would demoralize trade and extinguish honest competition to the impoverishment of those they disliked and the enrichment of their favorites. And if, by chance, selfish and ambitious men should ever acquire control of any considerable number of competing roads, they could, by disfavoring the refractory and rewarding the obsequious, largely influence both business and public sentiment within the radius of their influence, and thus increase their individual fortunes and strengthen their power.

"I am glad to be able to say, gentlemen, that railroad corporations are invested with no such dangerous power. Their officers are, in a qualified sense, trustees for the public as well as for the shareholders, and are in law as well as in morals bound to execute the trust imposed upon them by their charters, so as to secure to everyone applying therefor equal facilities in the use of their roads, and upon the same terms. You are to decide in this case whether there has been any discrimination made against this plaintiff. It is conceded that the schedule freight rates for 1876 from Salineville to Cleveland were \$1.60 per ton for the first 8000 tons shipped, thirty cents less on the next 8000 tons, forty cents less on the third 8000 tons, fifty cents less on the fourth 8000 tons, and sixty cents less on the fifth 8000 tons, and on all coal in excess of the last amount transported for any one man or firm. The effect of this rebate was to give to the heaviest shipper better rates than shippers of less amount enjoyed. Is such a discrimination authorized by law? I wholly dissent from the proposition that it is. If such a rebate is authorized in shipping coal, it is in transporting wheat or anything else transported in large quantities. The effect of such a policy would be to add to the strong and crush out the weak. If you find higher rates had to be paid by the plaintiffs than were exacted from others, such a discrimination is wrong to the plaintiffs, and they are entitled to reclaim what they overpaid, with interest."

After briefly referring to the claim that the plaintiff's business had also been injured by the loss of the dock privileges, and stat-

ing that all customers were entitled to equal chances for using the dock, the plaintiff having as much right to it as any one else, Judge Baxter concludes: "The plaintiffs state that their business was ruined by the discriminations and ask for damages on that account. At the beginning of the trial I declined to enter into an examination of that injury. These would come under the head of speculative damages and have no place here. Courts refuse in this form of an action to inquire into and determine this question. The plaintiff had a remedy for these damages at the time. He could have paid the high rates and then recovered back the overcharge by suit, or he could by an action in this court have compelled the defendant to extend to him the same privileges that others had. Although the overcharge may have been the legitimate cause of failure, that branch of the subject is now withheld from your consideration. There are three questions to be considered by you—the overcharges, the extent of the overcharges, and the amount of the overcharges."

Power and Speed of Torpedo Boats.—The power required to propel boats of different sizes is far from constant at all speeds. It happens that Messrs. Jarrold & Co., of England, recently had under trial two torpedo boats of different sizes, and as the results may be of interest to our readers, we annex the following facts: The larger boat was 100 feet in length and 12 feet 6 inches broad, having a displacement of 40 tons. The smaller one was 86 feet in length and 11 feet broad, having a displacement of 33 tons. To drive the 40-ton boat 15 knots required 248 indicated horse-power; 33-ton boat 15 knots required 277 indicated horse-power; 40-ton boat 18 knots required 394 indicated horse-power; 33-ton boat 18 knots required 390 indicated horse-power; 40-ton boat 21 knots required 540 indicated horse-power; 33-ton boat 21 knots required 510 indicated horse-power.

KEY-HOLE AND BAGGAGE GUARD.



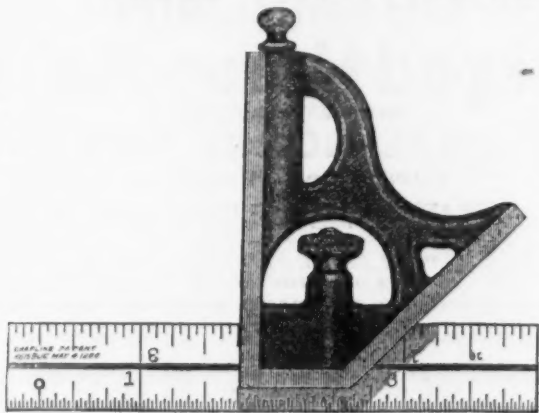
Pronounced to be the most ingenious and efficient protection against burglar and baggage thieves yet invented. Can be applied to any ordinary lock. Sample sent by mail on receipt of \$1. Illustrated circular and price list on application. Discount to the trade.

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CELEBRATED
WOOD WORKING

For Car Shops, Planing Mills, &c.
Also Machinery for all purposes. Correspond with us.

CHAPLIN'S PATENT TRY SQUARE AND MITRE, SPIRIT LEVEL AND PLUMB.



CENTRE SQUARE & DRAUGHTSMAN'S T-SQUARE.
STANDARD TOOL CO.,
ATHOL, MASS.

SOLE MANUFACTURERS AND OWNERS OF THE PATENT.

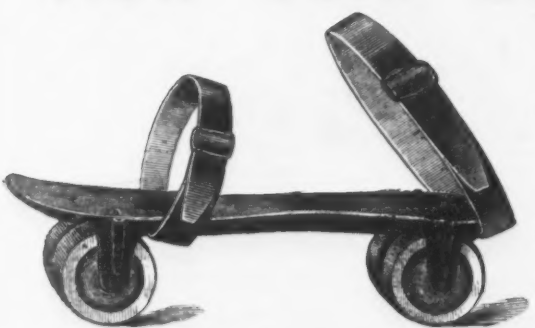
Circular, with Price List and Discounts, on Application.

New York Club Roller Skates.

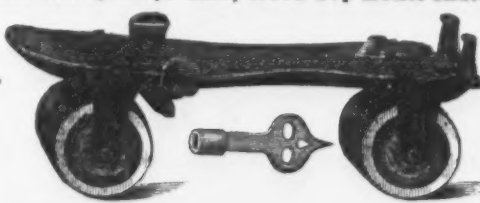
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Cheapest, best and most convenient, easily put on, simplest in construction, and most durable. Uniform tension, holds door firmly when closed.

Your Door Spring gives better satisfaction than any other we have ever sold.

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We think your Door Spring is the best in the market. We sold more of them last season than all other styles combined, and they have given universal satisfaction.

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Your Door Springs have given good satisfaction, and shall want more of them this season. The carpenters like them better than any other we have sold.

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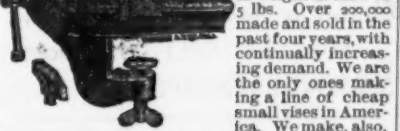
We offer to the trade the following low prices for a surplus stock: 20,000 dozen Loose Pin Butts at 60 and 10 discount; 5,000 dozen Loose Pin Butts, Japanned, at 70 discount; 5,000 Silver Tipped at 70 discount; Wire Cloth, \$2.40; Torrey's Door Springs, \$1.50; Strap and T Hinges, 100,000 dozen, at 50 and 10 discount; Wrought Butts, at 50 and 10 discount; Screws, 30 and 10; Locks, 50 per cent. and some at 50 and 10; 3-Ply Rubber Hose at \$2.50 per 50 feet. Couplings included; \$25,000 worth Stamped Tin Ware at 60 per cent. discount.

Above are subject to quantities on hand at time of receipt of order.

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19 Different Sizes and Styles.
from 3/4 to 24 inch width of jaws, and in weight from 1 to 15 lbs. Over 200,000 made and sold in the past four years, with continually increasing demand. We are the only ones making a line of cheap small vises in America. We make, also, Farmers', Machinists' and Coachmakers' Vises, and other goods. Send for Price List.

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P. S.—We furnish stands for holding full lines of the 12 Vises.

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New Upright Power Drill Presses; swing 22 inches, back geared, quick return motion large steel Spindle, balanced in column; revolving Arm and Table; cut Gears; Pulleys, 2 x 3/4; a strong brace extends from base to column, stiffening it at point of greatest strain.—a new feature. Weight, 100 lbs.; height, 6 feet. Price, \$20. Small size, swing 13 in., lever feed, three speeds; tight and loose pulleys (no countershaft required). Price, \$35.

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Fires from Spontaneous Combustion

May be prevented by using **MACHINERY WIPER CLOTHS**. Instead of cotton waste for cleaning Machinery, &c. Don't wait until you have a fire before waking up to the importance of adopting our Wiper Cloths. For sale by the trade generally, or by the **BROWN MANUFACTURING CO., Providence, R. I.** These Towels are the best for all kinds of cleaning. Price to consumers, \$2 per 100. Special prices to the trade.

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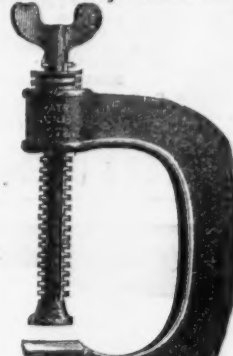
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Boiler, from 3 to 60 H. P. in stock and larger to order. Engines all sizes. Pumps, Heaters, Injectors, steam and hand Brick and Mortar Hoists, Boiler Test Pumps. The new Gravity Coffee Roaster. All of the above constantly kept in stock.

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Only a trial is needed to convince

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Owing to the unusual heavy orders at this season of

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TO, STATE DISTINCTLY WHETHER TO SHIP BY

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Buy the Eureka and you escape all infringements.

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The fact that the

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Sap Spouts was

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all other kinds out of the market and out of use,

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manufacture, sale and use of a Sap Spout, with its

inner end provided with longitudinal edges, fins or

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from the entire length of the bore; a Sap Spout

with its inner end provided with a chamber of

smaller dimensions around its neck for the free

flow of sap between the outer packing and inner

bearing; a wire bucket hanger detachable, or one

PERMANENTLY attached to, or one cast integral,

with, a Sap Spout; a Sap Spout with its extreme

outer end provided with a drop-lip or nub on its

under side for facilitating the quick discharge of

sap from out the spout into the bucket—all of which

are some of the essential points patented or owned

by me, and their infringement by manufacture,

sale or use will receive the full penalties of the law.

Suits for damages have already been brought

against leading infringers, and others will surely

follow unless voluntarily settled.

BUY THE EUREKAS AND YOU ESCAPE ALL

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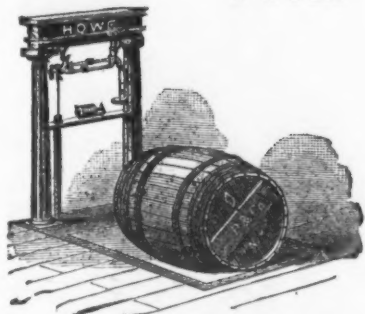
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Also the Rotunda Per-

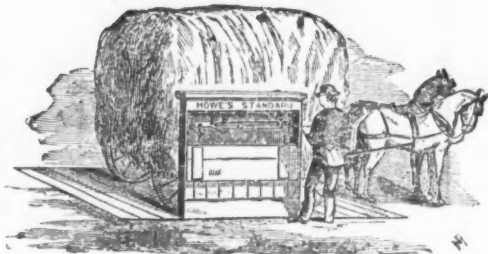
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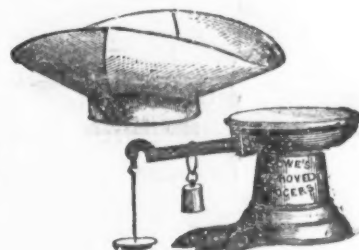
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ADAPTED
TO THE
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COUNTRIES.



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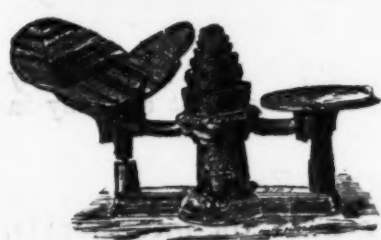
MANUFACTURED BY THE
HOWE SCALE COMPANY, Rutland, Vt.

Established 1856.

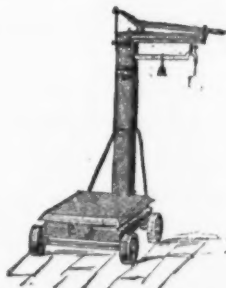


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JOHN TURNER, Treas.

JOHN SHORE, Sec'y.

To Manufacturers, Bleachers, Dyers, and all Users of Steam: We wish to call your special attention to our PATENT STEAM TRAP, acknowledged by practical engineers and manufacturers to be the best, simplest, most effective and durable Trap ever brought before the public. The simplicity of this Trap consists of doing away with all expansions and contractions, no glands or stuffing boxes, or bolts of any description required; no compound cylinders and no copper rods. The cover can be removed at any time to see it work; and if required the discharged water can be elevated from two to thirty feet, so that it can be used for other purposes. They will last from thirty to forty years. As regards frost and snow it makes no difference, as we have had and still have one working in the open air at Washington Mills, Lawrence, Mass., and it has done its work well, never having had any trouble with it, and bids defiance to all weather. That they have been thoroughly tested can be seen by the testimonials given below, of the few that have come to hand:

TESTIMONIALS.

Washington Mills, Lawrence, Mass., November 18, 1880.

Mr. R. Newton.—DEAR SIR: The Steam Trap we bought of you last August works admirably. Please send us another as soon as possible. Yours truly,
JAMES B. SINGER, Mech. Supt.

Office of Washington Mills, Boston, December 24, 1880.

Providence Steam Trap Co.—GENTLEMEN: Please forward to Washington Mills as soon as possible six (6) 1/2 inch Traps and send bill to me.
Yours, truly,
HENRY F. COE, Treas.

Clyde Bleachery and Print Works, River Point, R. I., January 17, 1881.

Mr. R. Newton.—DEAR SIR: The Steam Trap we had of you is in successful and very satisfactory operation. Its simplicity in construction and undoubted durability will commend it to all who are in want of a superior Steam Trap. We shall order more when in need of any. Yours, truly,
S. H. GREEN & SONS.

Kendall Manufacturing Co., Providence, R. I., Feb. 1, 1881.

Providence Steam Trap Co.—GENTS: We have used one of your Steam Traps for some time and would say that we find it gives perfect satisfaction.
Yours, truly,
NICHOLAS SHELDON, Treas.

A. & W. Sprague Mfg. Co., Cranston Print Works, R. I., Jan. 15, 1880.

Mr. Robert Newton.—DEAR SIR: The Steam Traps we bought of you work first-class and give every satisfaction, and appear to be very durable. We think them the best Steam Trap that we have ever had. When in want of more will write you. I remain, yours, truly,
THOMAS BRISTOW, Supt. Cranston Print Works.

Providence, R. I., December 18, 1880.

Mr. Newton.—DEAR SIR: We have your Steam Trap working satisfactorily and can conscientiously recommend it to all.
Yours, very truly,
B. COLLINGHAM, Supt. Atlantic Mills.

ROBERT NEWTON, C. E. M. E., Inventor and Patentee, Providence, R. I.

PATENT OSCILLATING FIRE BARS.

We wish also to call your attention to R. Newton's PATENT OSCILLATING FIRE BARS, which for durability, economy and application are acknowledged by all practical engineers that have seen them up to the present time to be the best ever brought before the public. This invention the patentee has labored at more or less since 1851. These bars have long been wanted, and their use will at once prove their efficacy as an economiser of fuel and labor. These bars can consume from four to twenty-six pounds of coal per square foot of grate, per hour, and not warp; and the apertures can be kept clean so that they can get a regular supply of oxygen, which is the life-giving power of calorific. They can be applied to all kinds of boiler surfaces (except vertical), and can be fitted to the furnaces in about five hours. Testimonials can be forwarded, if required, to show that they are now in use in some of the largest firms in the world.

SOME OF THE ADVANTAGES: These bars allow the use of inferior coal; evaporating power is greatly increased. This is a great boon where boiler power and space is limited. This advantage cannot be over-estimated in the case of marine boilers. The oscillating of the fire bars both cuts and lifts the slug, and clears the apertures at the same time. The bars give four motions in one oscillation, and cannot get out of order. They are also free of expansion and contraction, both longitudinal and transversal, and however careless the stoker may be he cannot leave them so as to take any harm. They are so cast, and of such metal, that they are the most durable bar ever brought into use. All now in use are very much approved. Their cost is so reasonable that they come within the reach of all. The company are now granting licenses to several firms to make and apply them, and are open to arrange with other parties. N. B.—The company furnish first sets of models.

ROBERT NEWTON, C. E. M. E., Inventor and Patentee.

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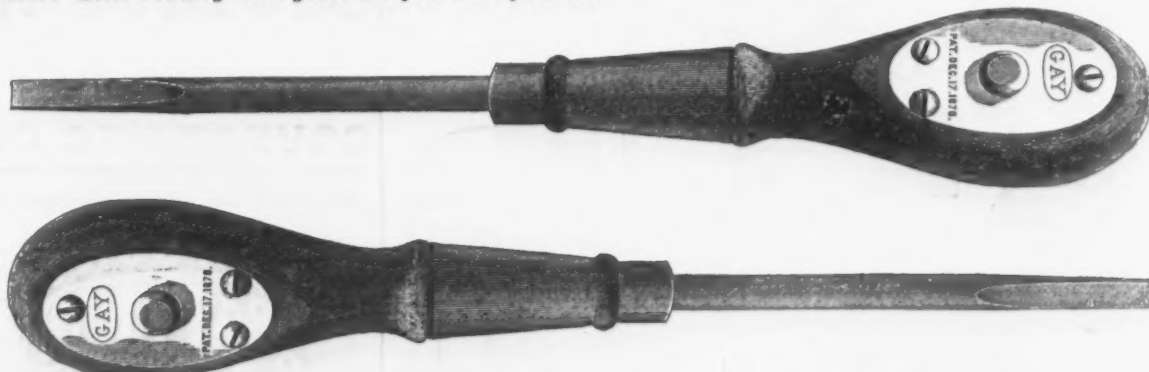
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For Setting Steam Boilers.



Economy of Fuel, with increased capacity of steam power.

The same principle as the SIEMENS PROCESS OF MAKING STEEL; utilizes the waste gases with hot air on top of the fire.

Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c.

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Also, Surface Gauges and Counter Sinks, Stevens' Patent Breech-Loading Sporting Rifles, double and single barrel, Shot Guns, Pocket Rifles, Pocket Pistols, and the noted Hunters' Pet Rifles. Our Shooting Gallery Rifle is the favorite everywhere.



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Manufacturers of

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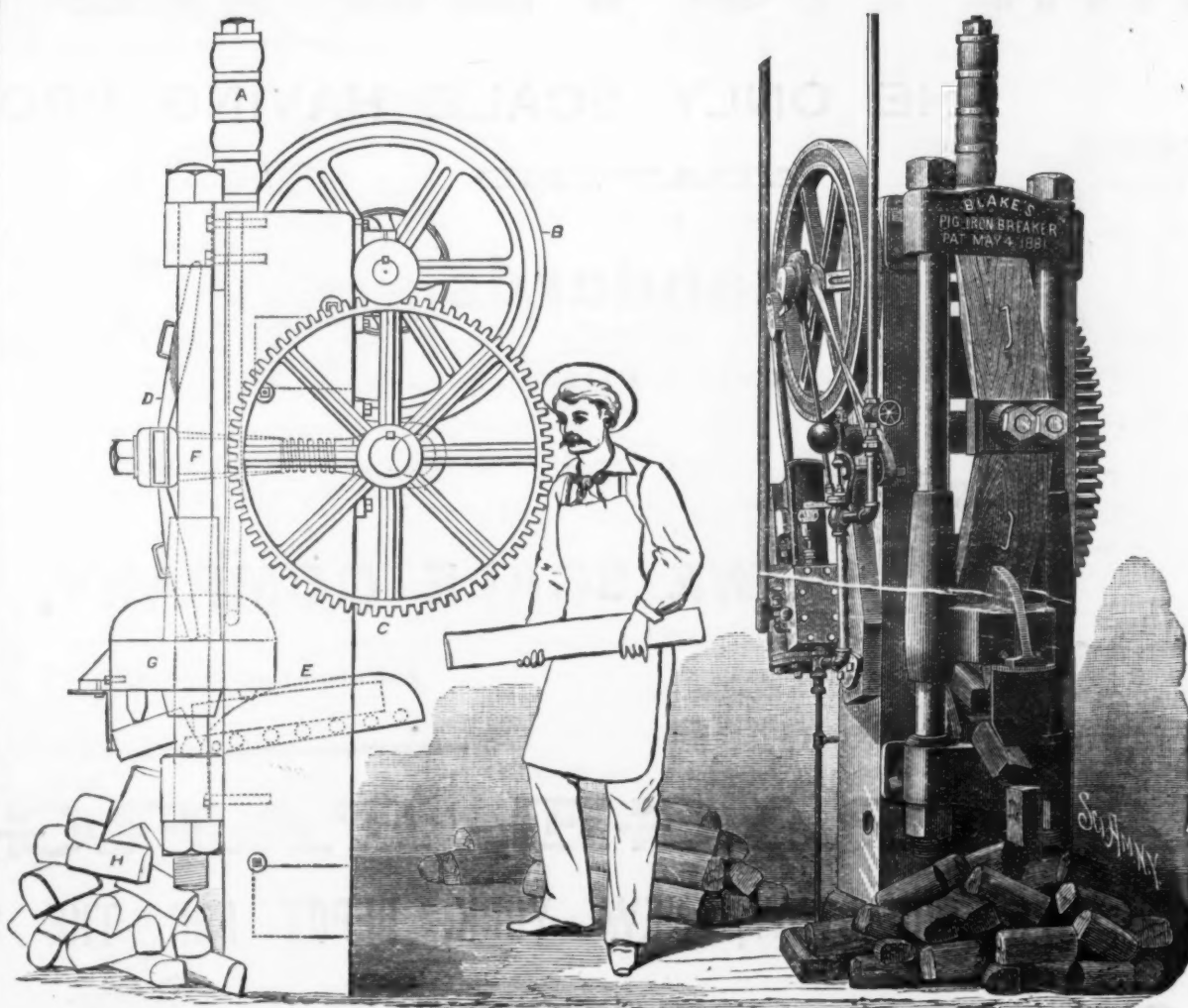
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Works, 147 and 149 Elm Street,

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A new and successful machine for breaking pig iron, into any length desired, with rapidity and economy. Besides saving in cost of breaking by hand, it secures the greatest economy in melting. Several machines already in use.

Every Machine Guaranteed against Breakage of Parts.

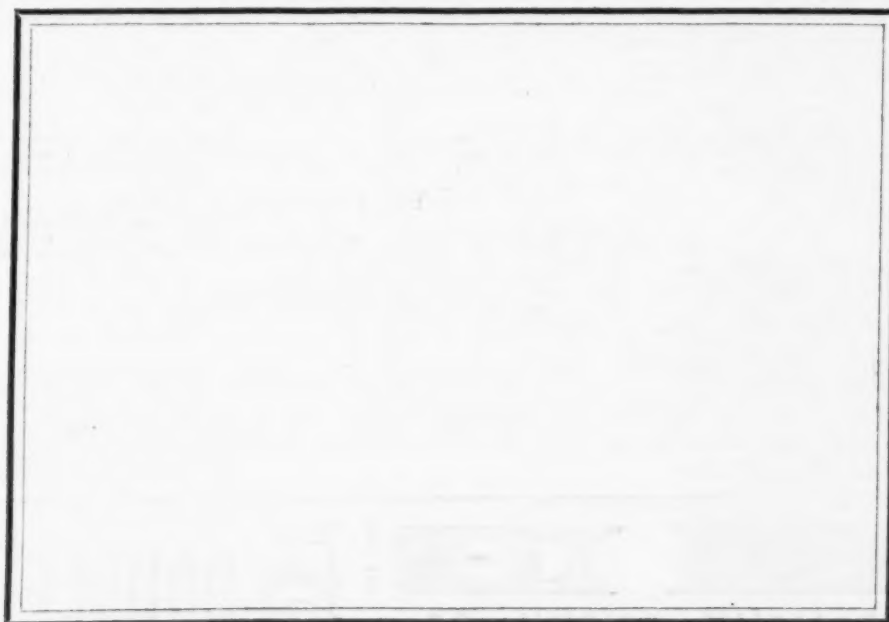
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Sold by all leading jobbers in General and Saddlery Hardware, and the same discounts given from the list to the trade as when purchased direct from the factory.

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The Spofford Bit Brace is made under Letters Patent of the U. S. A., granted to N. Spofford, March 23, 1886 assigned to Fray & Pigg, and now held by John S. Fray, Mr. Pigg having retired from the firm.

All Iron, Five Sizes.

No. 7.....7 inch sweep. No. 107.....7 inch sweep. No. 70.....7 inch sweep.

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No. 10.....10 inch sweep. No. 110.....10 inch sweep. No. 83.....10 inch sweep.

No. 11.....11 inch sweep. No. 111.....11 inch sweep. No. 84.....11 inch sweep.

No. 12.....12 inch sweep. No. 112.....12 inch sweep. No. 85.....12 inch sweep.

No. 13.....13 inch sweep. No. 113.....13 inch sweep. No. 86.....13 inch sweep.

No. 14.....14 inch sweep. No. 114.....14 inch sweep. No. 87.....14 inch sweep.

No. 15.....15 inch sweep. No. 115.....15 inch sweep. No. 88.....15 inch sweep.

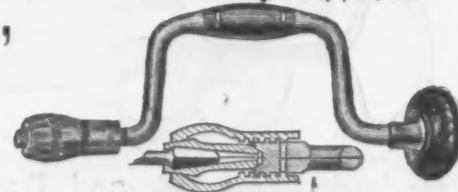
No. 16.....16 inch sweep. No. 116.....16 inch sweep. No. 89.....16 inch sweep.

No. 17.....17 inch sweep. No. 117.....17 inch sweep. No. 90.....17 inch sweep.

No. 18.....18 inch sweep. No. 118.....18 inch sweep. No. 91.....18 inch sweep.

No. 19.....19 inch sweep. No. 119.....19 inch sweep. No. 92.....19 inch sweep.

No. 20.....20 inch sweep. No. 120.....20 inch sweep. No. 93.....20 inch sweep.



Spofford Sleeve Brace.

DE-OXYDIZED BRONZE.

DE-OXYDIZED BRONZE (patented) is an alloy of **LAKE COPPER** and best **ASIATIC TIN** in any proportion required, so as to be either as **ductile as copper**, as **tough as iron**, or as **hard as steel**, according to the proportion of Copper and Tin used.

The **process** of making the alloy is what constitutes its superiority over any other known alloy of Copper and Tin or any other Bronze composition. The castings made from this metal, owing to its perfect fluidity when melted, possess great density, perfect soundness and homogeneity. Unlike certain bronze and other compositions, it can be **handled without the least difficulty by any ordinary founder**, as it flows like oil in pouring.

Thus the necessity and trouble of shipping patterns, the delay in receiving castings and the expense of the double charges of freight or express, such as attend the obtaining, in many cases, of Phosphor Bronze, are entirely avoided by ordering **D. O. B. in ingots**. Where this metal has superseded other compositions of similar character, it has **endured three times as long**. In a word, we claim that **De-Oxydized Bronze** not only has none of the objectionable features attributed to similar compositions, but that it possesses all their good qualities in addition to its own merits, and advantages peculiar to itself, such as the following summary will make clear:

1. **ITS GREAT CONVENIENCE IN HANDLING** as compared to Phosphor Bronze.
2. We claim for it **SUPERIOR ANTI-FRICTION QUALITIES** to any other known Brass or Bronze.
3. **GREAT MALLEABILITY AND TENACITY.**
4. Its **homogeneousness and smoothness of surface** render it capable of the **HIGHEST POLISH.**
5. As before mentioned, we claim for it **UNEQUALED ENDURANCE.**
6. We claim that **JOURNALS MADE of D. O. B. REQUIRE ONE-FOURTH LESS LUBRICATING MATERIAL** than any other composition yet known.

Finally, this metal has never failed to give more than satisfaction wherever used. To sustain our statements, the following testimonials will suffice:

Henry Disston & Sons, Saw, Tool, Steel and File Works, Front and Laurel Streets, Philadelphia Smelting Company, City:

PHILADELPHIA, October 4, 1879.

GENTLEMEN: After a trial of eighteen months of your "DE-OXYDIZED BRONZE" as Journal Boxes in our Rolling Mill, where great pressure is required we take pleasure in recommending it as being superior to any we have heretofore used. Very truly,

HENRY DISSTON & SONS.

Office of Eagle Iron Works, 1162 North Third Street,

Philadelphia Smelting Company:

PHILADELPHIA, August 29, 1879.

GENTLEMEN: In reply to yours of the 28th inst., we beg to say that we have been using your "DE-OXYDIZED BRONZE" for over a year, and have found it better than any composition boxes we have used; and as long as

you continue to make it the same quality, we shall use no other metal in our Engine Boxes. We therefore take pleasure in recommending it to Engine Builders in general.

Yours respectfully,

HOFF, FONTAINE & ABBOTT.

Office of Union Brass Manufacturing Company,

CHICAGO, Dec. 23, 1880.

Philadelphia Smelting Company, Limited, Twelfth and Noble Streets, Philadelphia, Pa.:

DEAR SIR: In reply to your inquiry of yesterday as to our opinion of "DE-OXYDIZED BRONZE" for Railway Coach Trimmings, I beg to submit that we have used it up to present writing for the trimming of something over 100 coaches. One marked peculiarity of this metal, when highly finished, is non-liability to abrasion, and its non-affinity with the gases of the atmosphere, which in embossed work is a great desideratum. To those willing to pay more in the first cost, we would confidently recommend "DE-OXYDIZED BRONZE" Trimmings as cheaper in the end.

Yours very truly,

J. HALL DOW, President.

This metal is used for the following purposes, and we can refer to large concerns in addition to above, through the New England and Middle and Western States, who are using it in preference to any other.

1. **Engine, Car and Machinery Journals.**
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And for any other purpose that a **handsome, durable and sound Bronze** is required. We especially commend it to **Railroad Companies, Car Builders, Machinists, Engineers** and others requiring a **Journal Metal** that will stand the **severest friction and the heaviest pressure**.

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where high speed and great pressure are required.

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JAMES BUTTERWORTH & SON.

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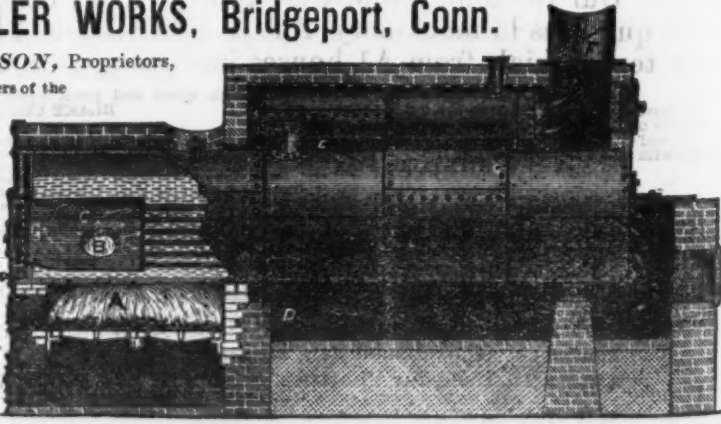
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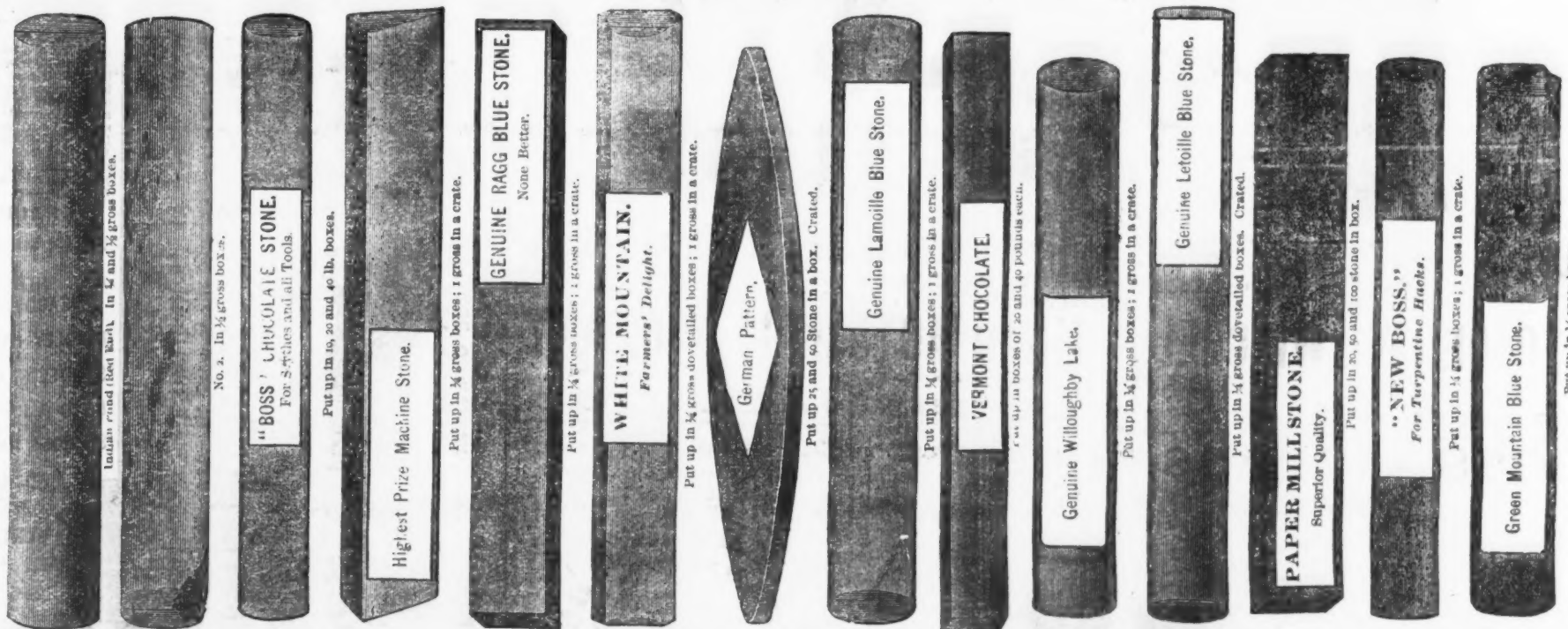


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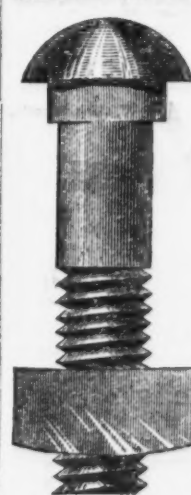
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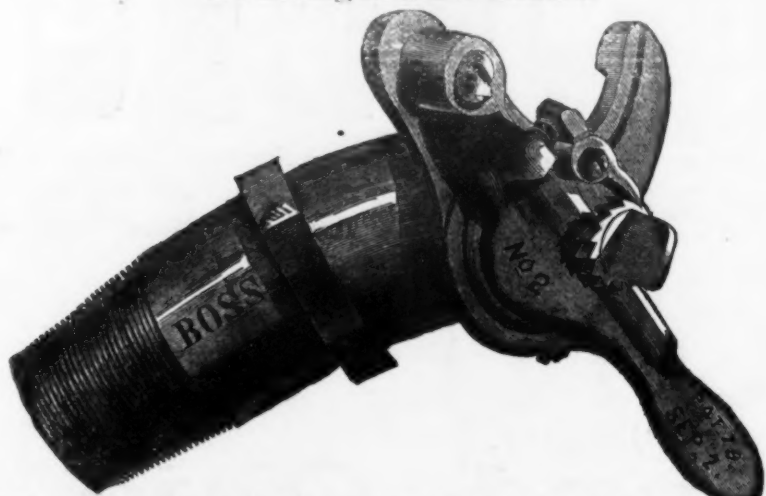
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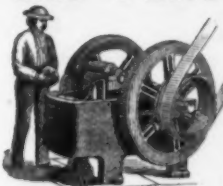
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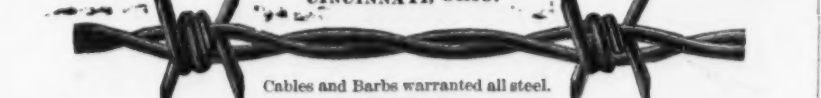
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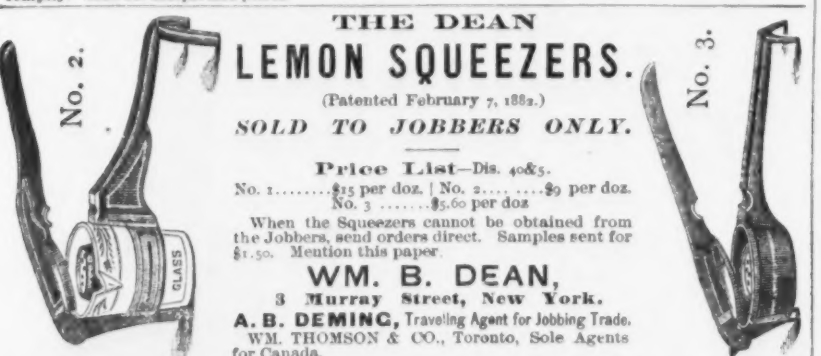
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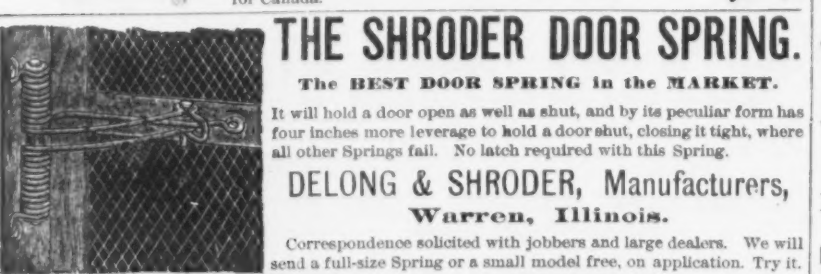
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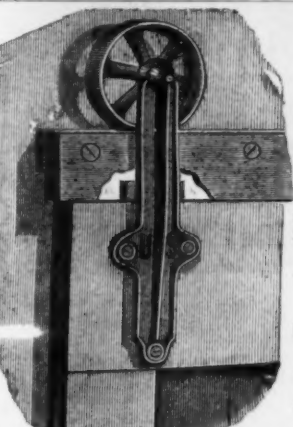
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BARN DOOR
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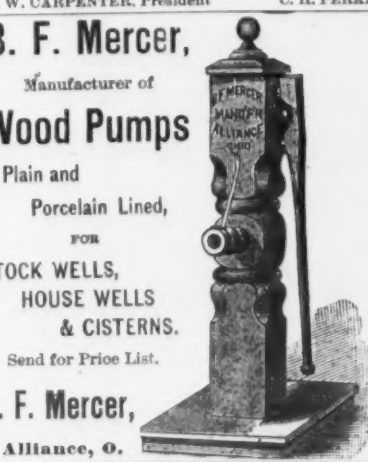
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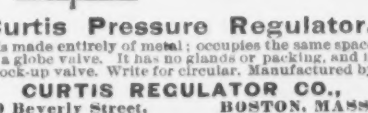
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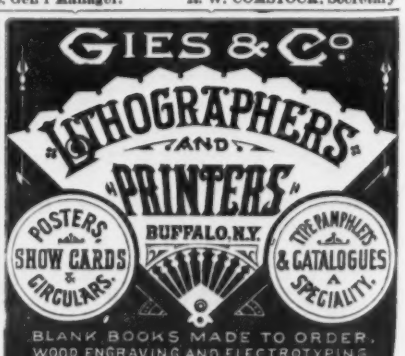
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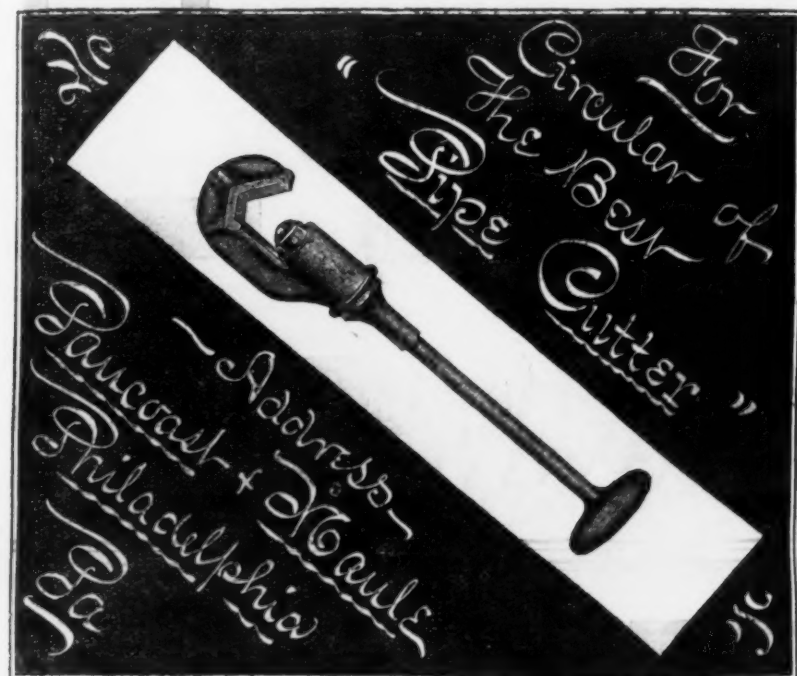
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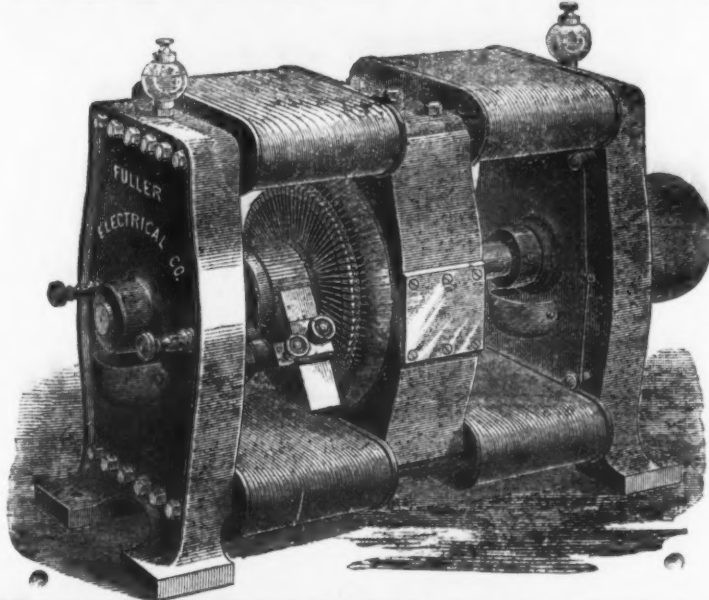
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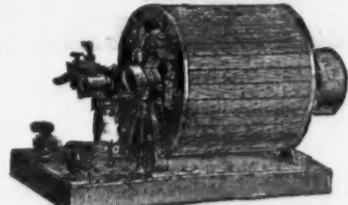


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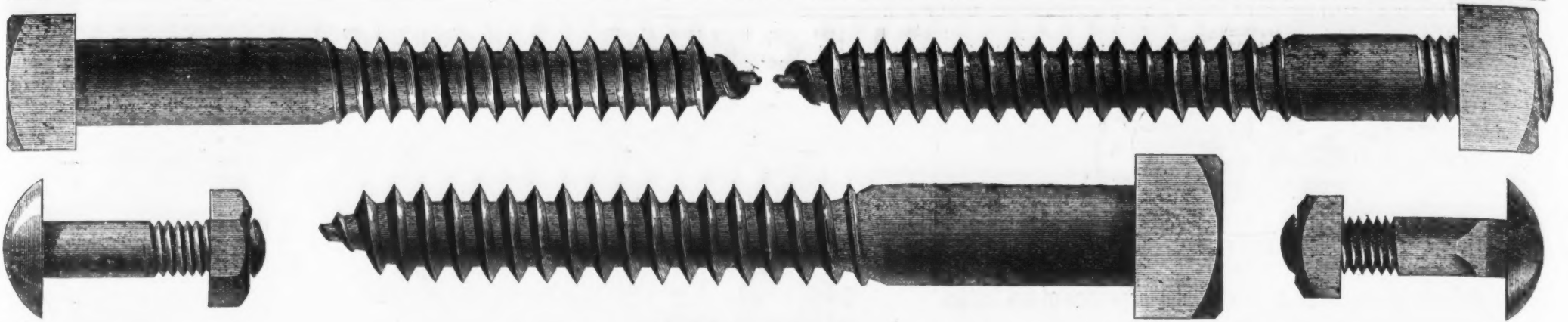
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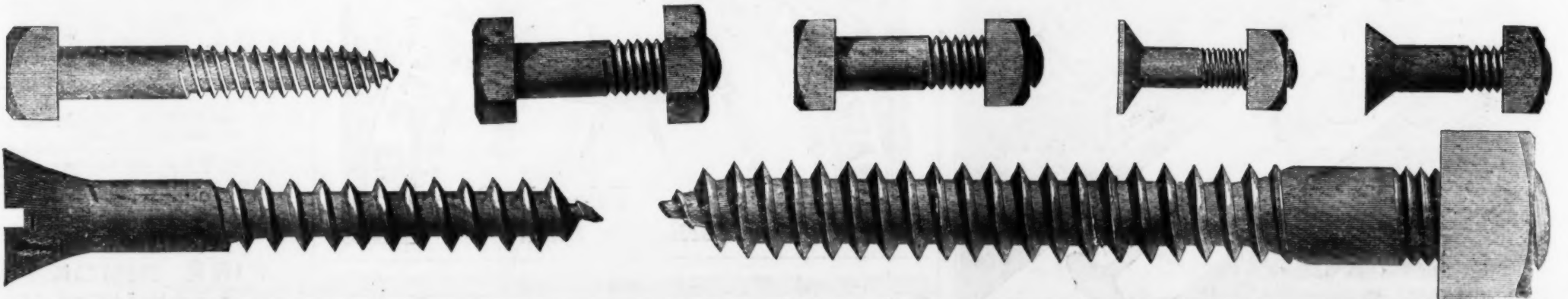
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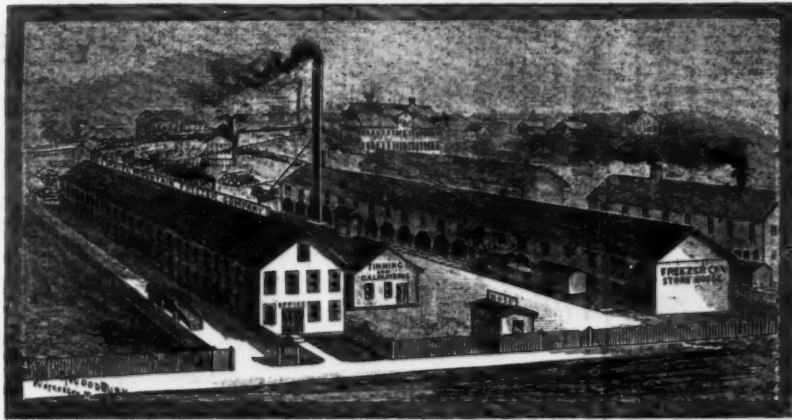
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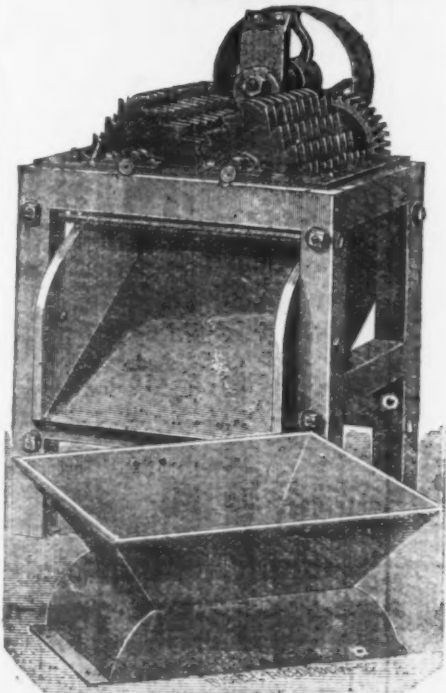
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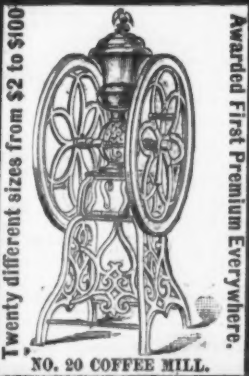


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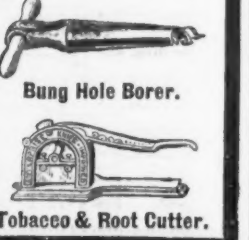
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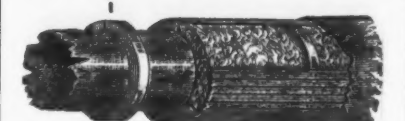


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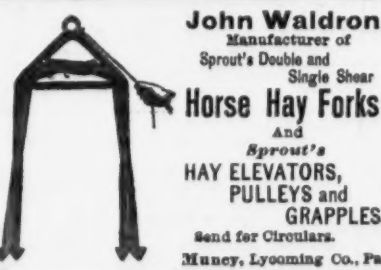
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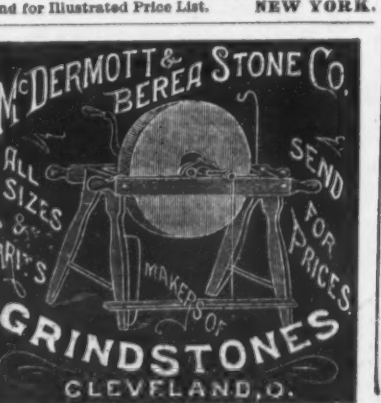
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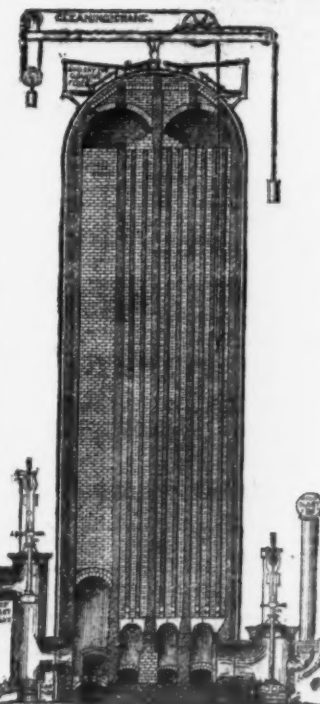
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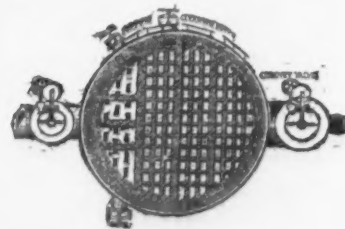
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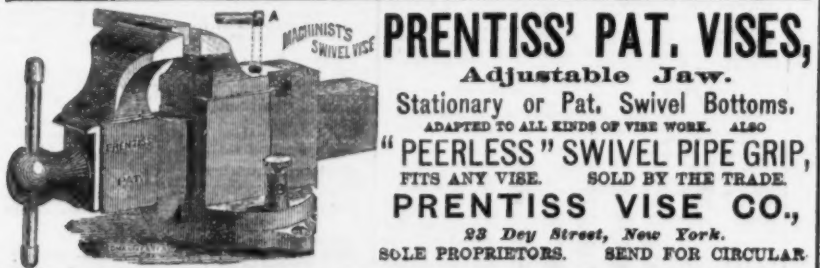
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See Page 3.

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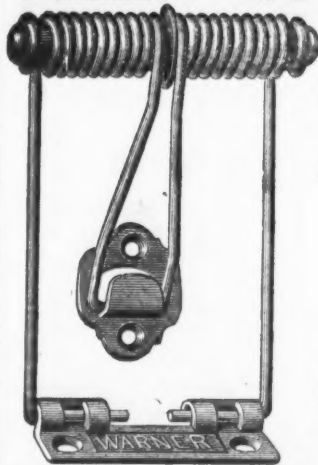


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With which is incorporated The Universal Engineer,

is published every fourth week in connection with the extensive and world-wide circulation of the Ironmonger itself. The dates of its publication for the next twelve months will be as follows: MARCH 25, APRIL 22, MAY 20, JUNE 17, JULY 8, AUGUST 5, SEPTEMBER 2 and 30, OCTOBER 28, NOVEMBER 25, DECEMBER 23, 1882.

JANUARY 20, and FEBRUARY 17, 1883.

This Supplement is published in

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so far as our experience of twenty years is concerned, will be covered by THE FOREIGN SUPPLEMENT at least twice a year. Thus a Price List or advertisement inserted in the Ironmonger and Foreign Supplement is a strikingly powerful and most efficient way of publicity not to be compared with any other ordinary channels of communication.

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KEYSTONE SAW, TOOL, STEEL & FILE WORKS,

Front and Laurel Streets,

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DISSTON'S SAMSON TREE PLANTER AND POST HOLE DIGGER.

Fig. 1.

Patented May 29, 1870.

Fig. 2.

Price, - - - \$37.50 per dozen.

No Farmer, Nurseryman, Railroad
or Telegraph Company
SHOULD BE WITHOUT ONE.

NO BACK-ACHE.

NO KNEE-WORK.

NO CLOGGING.

This tool has been thoroughly tested, and has given the greatest satisfaction to all who have tried it. The principle on which it works makes it self-cleaning and prevents adhesion in sticky soil; therefore it always works free and easy. It is far superior to all plungers, augers and boring machines, as it works well in stony, sandy, or clay soils; quicksand under water is as easily removed as though no water existed.

DIRECTIONS.

Plunge the Digger into the ground, as shown in cut, Fig. 1, and when the soil is loosened pull out the lever with one hand, as shown in cut, Fig. 2, which will press the dirt between the blades; then draw the Digger from the hole, keeping hold of the lever with one hand and the handle with the other. When the Digger is clear of the hole, you can deposit the load anywhere within reach by simply pressing down the lever, which will open the blades and the dirt will fall from between them. The Digger is then ready for another plunge. The steel blades are nine inches long, and the whole tool five feet long. For sale at Hardware and Agricultural Stores.

HENRY DISSTON & SONS.

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No. 81 Murray Street, New York.

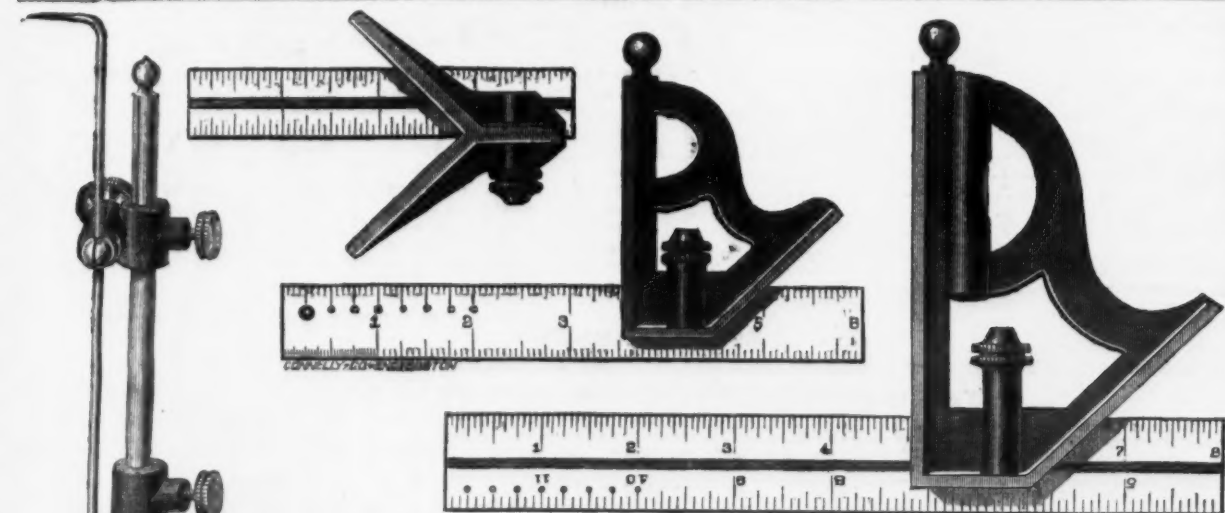
Hardware Manufacturers' Agents, and Headquarters for

HORSE SHOES, HORSE NAILS, TOE CALKS, CALKING STEEL,

Bayliss' Bellows, Forges and Tuyeres,

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Starrett's Improved
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Can be quickly and accurately adjusted to lay out work for every conceivable purpose a gauge is used for.

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Adjustable Square

Includes Mitre, Plumb and Level, also the best Centre Square made. One is a complete substitute for a full set of the old style squares, and warranted accurate.

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This is to inform the public that since the success of my Patent Squares has become known, unprincipled parties have had the foolhardiness to make them, under the Pretext of Chaplin's Patent. Having commenced suit against said parties, I shall soon put a stop to their manufacture, and shall hold all selling or using them responsible.

Respectfully,
L. S. STARRETT.

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Manufacturers of
ROTARY KNIFE PEACH PARERS, GOLD MEDAL APPLE
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IVES' PATENT
Burglar-Proof Door Bolts.
For sale by leading Hardware Jobbers
throughout the country.
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Sole Manufacturer and Patentee,
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Send for Illustrated Price List.

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MANUFACTURERS OF.

PORTER'S PATENT WINDOW & DOOR SCREEN CORNERS ETC.

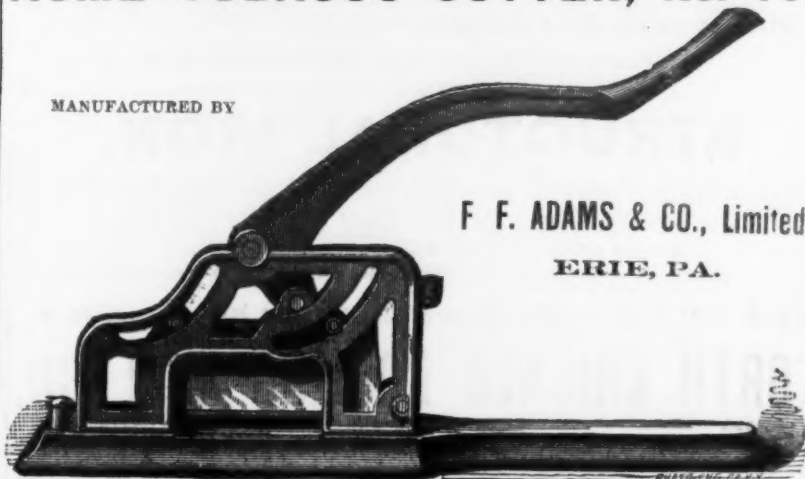
EVERY ONE HIS OWN WINDOW & DOOR SCREEN MAKER.
NO MORTISING OR TENONING, CANNOT SAG OR WARP,
AND ANYONE CAN MAKE THEM. SEND FOR PRICE LIST.

NEW YORK, BY GRAHAM & HAINES, 113 CHAMBERS ST.
CHICAGO, BY W. PICKETT & SON, 164 LAKE ST.

ACME TOBACCO CUTTER, No. 10.

MANUFACTURED BY

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Amesbury's Band Saw Filing Machine.

Will Save its Cost in a Few Weeks.

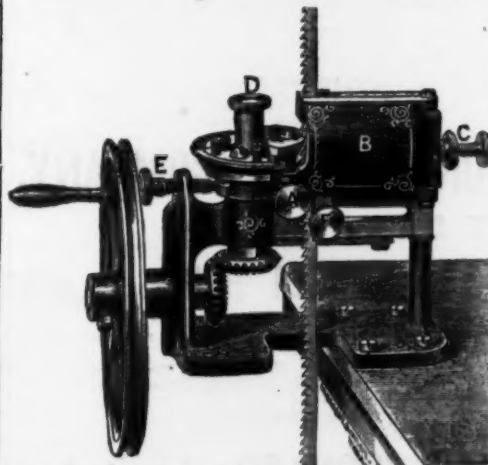
Any boy that can turn a crank can file a hand saw in from five to ten minutes more accurately than an expert filer can do the same by hand in one hour. Keeps the teeth even and level, and enables the saw to do more and better work with much less strain. Pronounced by users to be the best labor-saving machine ever introduced.

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BEST BAND SAW FILING MACHINE.

Is sold at a price within the reach of every one using a hand saw. Reduced Price List.—Net price, including 20 files, \$35; thin, corner and facing files, per dozen, \$1.50; thick beveled files, per dozen, \$1.50. Terms strictly cash. Send for Catalogue and Testimonials.

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LARGE CIRCULAR SAWS.

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HENRY'S PATENT UNIVERSAL CAN OPENER.

Samples sent free for 30 cents.



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WARRANTED
The Best and Cheapest Shoe Made.
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FINE GRAY IRON CASTINGS OF EVERY DESCRIPTION.
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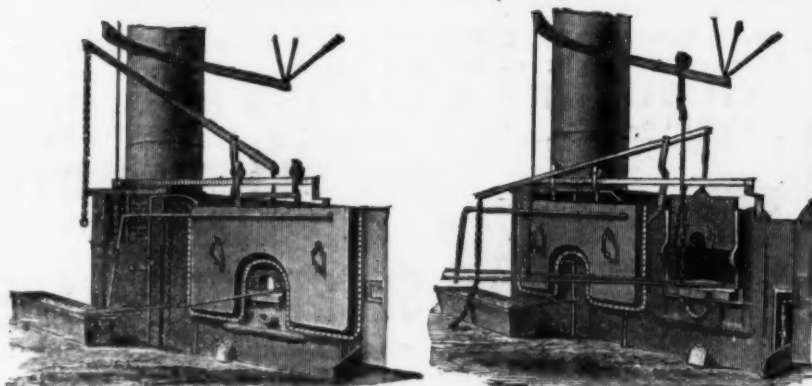
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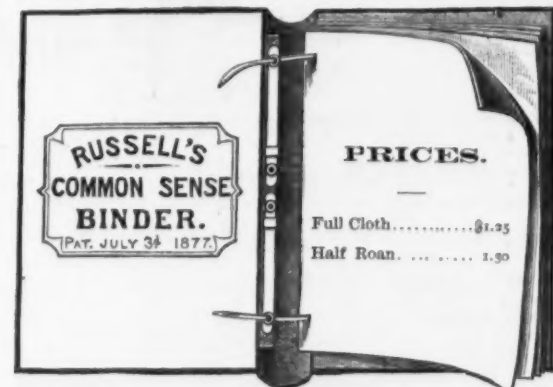
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NEW BEDFORD, MASS., Sole Manufacturers of
Morse Patent Straight-Lip Increase Twist Drill,
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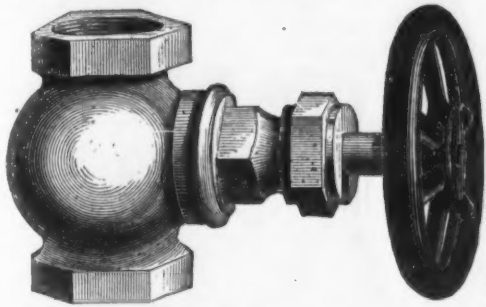
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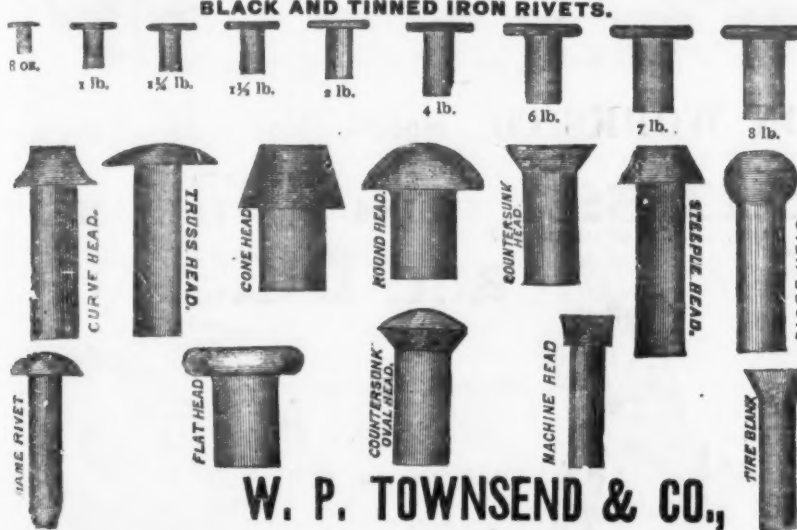
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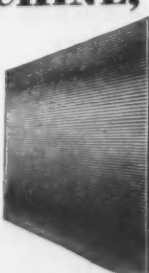

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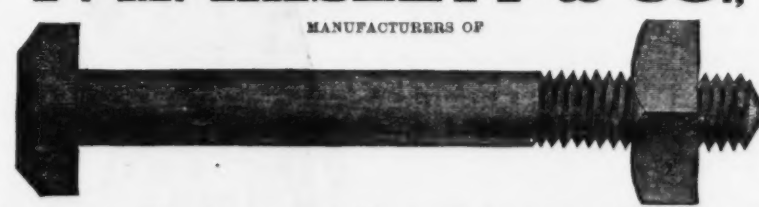

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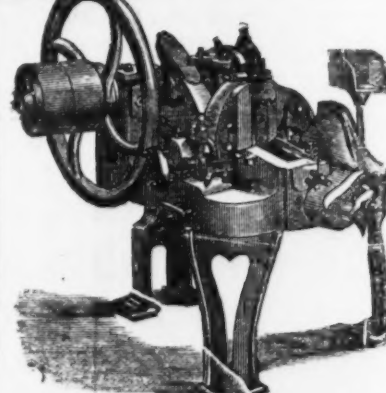
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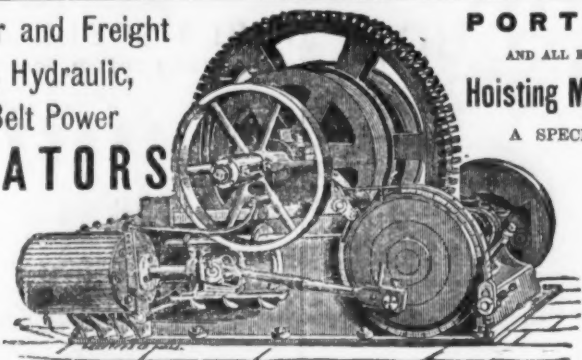


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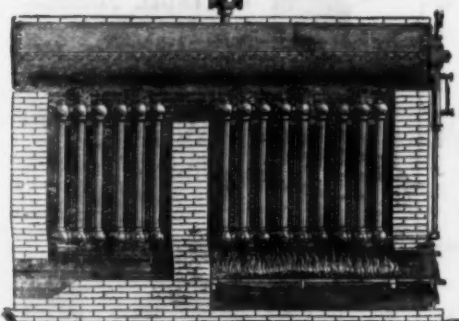
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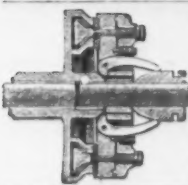
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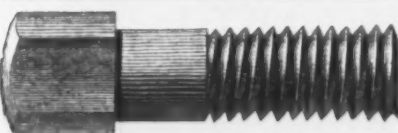
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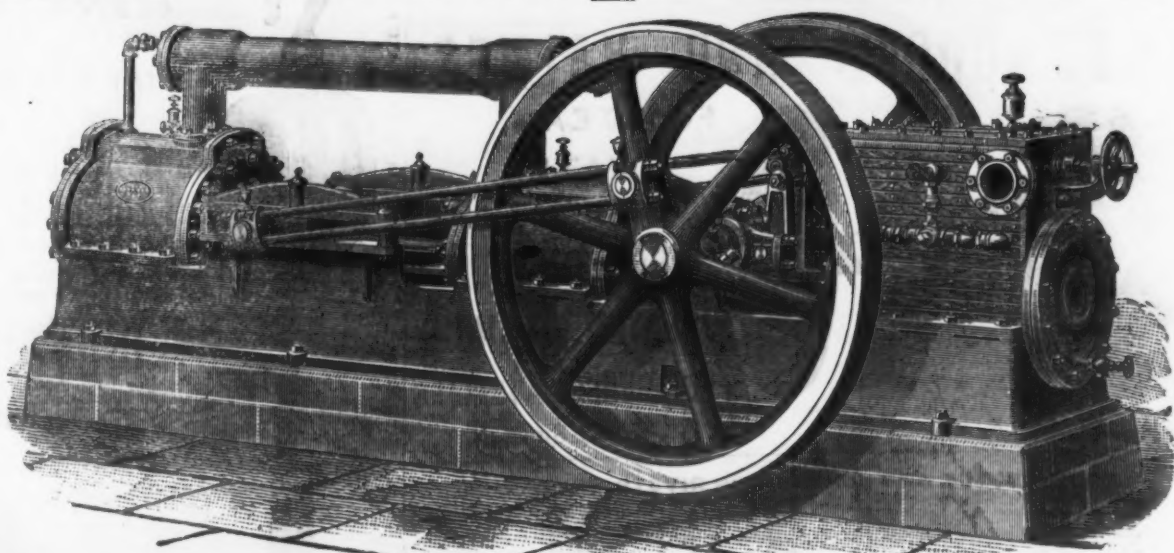
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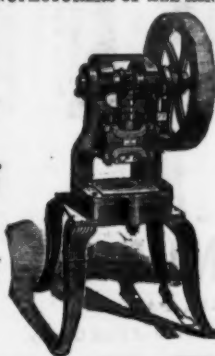
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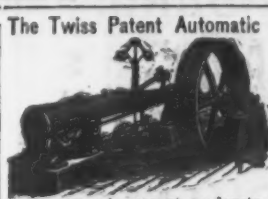
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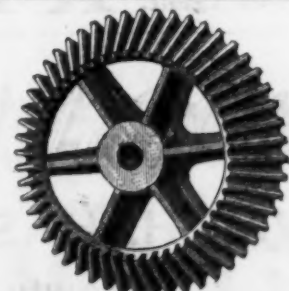
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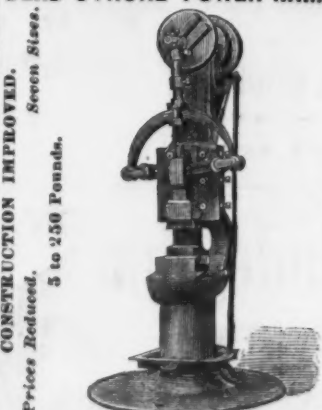
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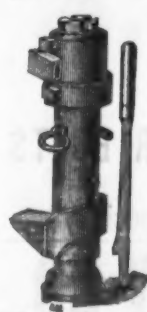
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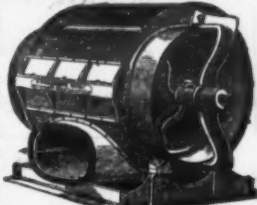


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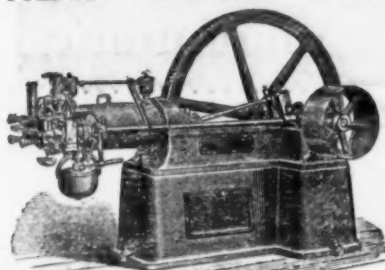
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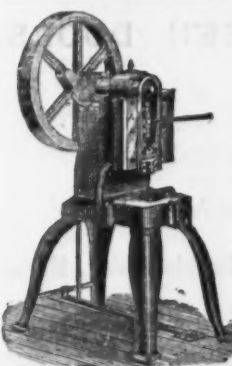
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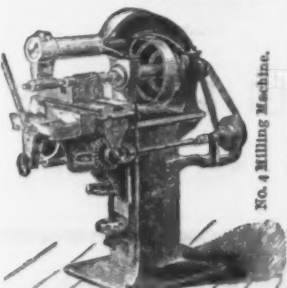
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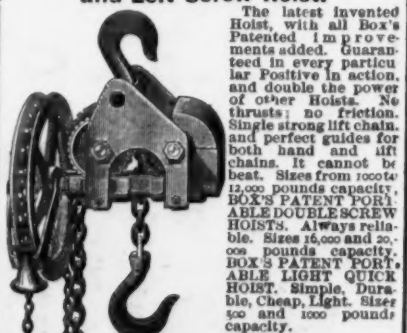


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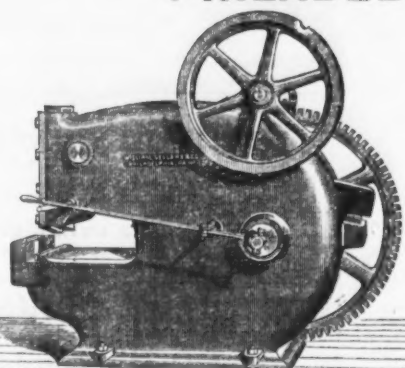
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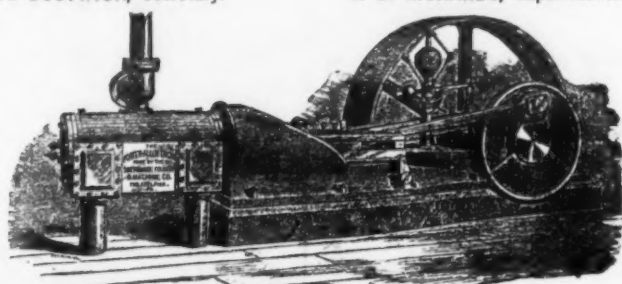


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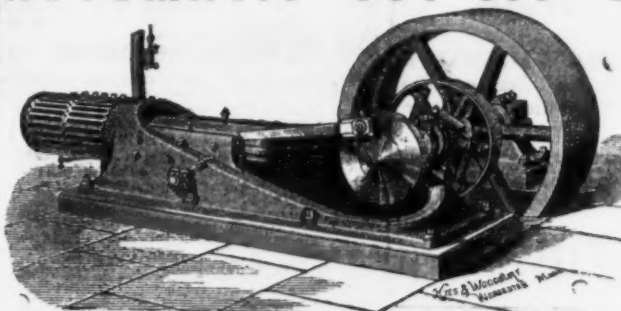
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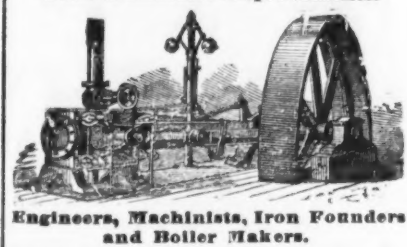
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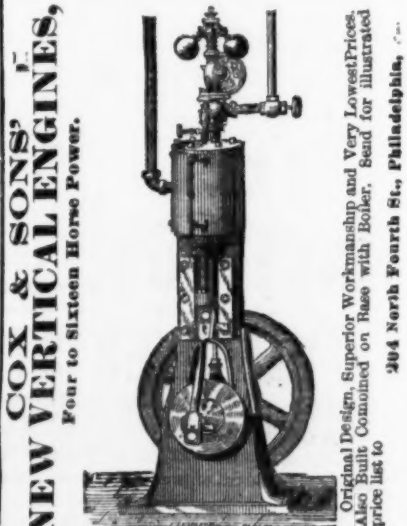
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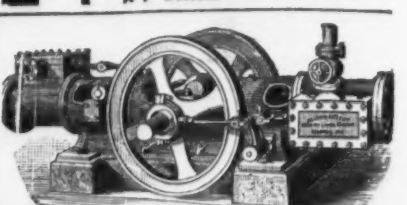


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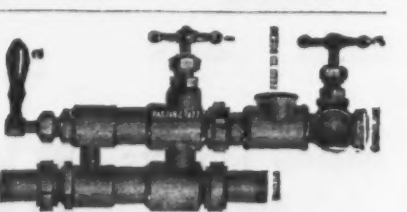
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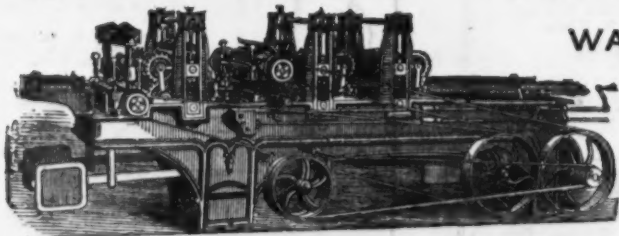
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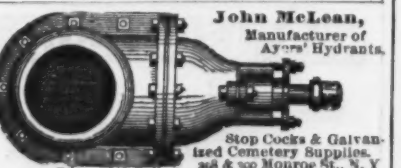
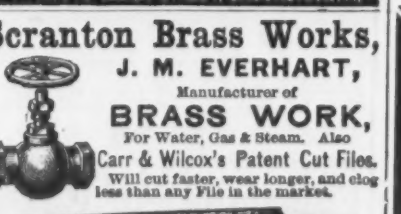
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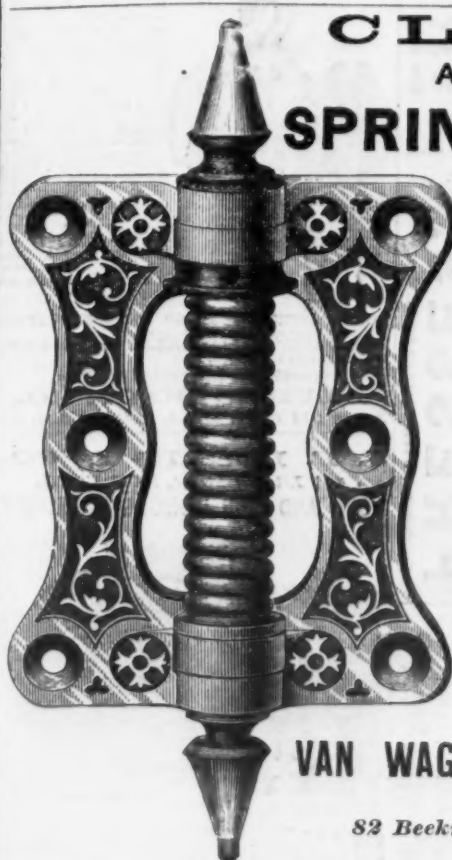
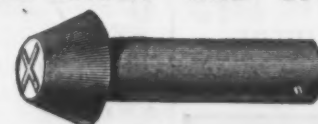
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